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CQ VHF

Ham Radio Above 50 MHz

April 1998

Springtime Mobile Special!

- **Put a Ham Rig on Your Bike!**
- **100+ Miles on 2-Meter Mobile!**
- **N4RVE: From "BEHEMOTH" to "Microships"**

Plus . . .

- **The *CQ VHF* National Foxhunting Weekend**
- **Two New Columns: "Antennas, etc." "How It Works"**

On the Cover: Steve Roberts, N4RVE, makes a stop with his BEHEMOTH bicycle, somewhere in California's Silicon Valley. Details on Page 68; article on what's next on Page 16.

U.S. $2.95 CAN / INT'L $3.95

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■ Repeaters ■ Packet Radio ■ VHF/UHF Weather ■ Microwaves ■ Amateur Satellites ■ Plus...Reviews, Upgrade Tips, Product News, VHF Basics, and much more!

Grab Hold of ICOM!

FREE Windows™ Software and Cloning Cable with Purchase of Any of the Radios Below*

IC-T2A

SUPER-RUGGED & PC PROGRAMMABLE

Planning a trip? Now with the **EASY-TO-PROGRAM** IC-T2A 2M handheld and a PC you can plan your ham communications ahead of time! Download stored frequencies, like those found in a repeater directory, from your PC directly into the IC-T2A. Take up to 40 pre-programmed frequencies with you. And it's ICOM rugged – meets **MIL SPEC C/D/E**. Front panel keys are large and well spaced. Single tactile knob for on/off and volume – squelch is handled automatically or manually. The IC-T2A uses either **ALKALINE OR NI-CD** batteries. Included with the IC-T2A are 8 "AA" rechargeable Ni-Cd batteries. Or swap them out for "AA" alkalines. Your choice.

IC-W32A

ADVANCED FEATURES, EASY TO USE

Slim and compact, the IC-W32A is ICOM's top-of-the line 2M/440MHz dual bander. Up to 5 watts of power, **NO FUNCTION BUTTON** (simple to operate!) and plenty of whistles and bells. For example, a VHF/UHF exchange function allows you to assign VHF/UHF tuning and volume to either knob. A "guide" function provides quick identification for button assignments. Receive two frequencies on one band or search for signals on one band while waiting for a transmission on the other (V/V and U/U). With **200 MEMORY CHANNELS** (100 per band) and 8-character alphanumeric tags, your favorite frequencies are always at hand. Use **PC PROGRAMMING** or the keypad to set features and memories. Get CTCSS encode/decode, CTCSS tone scan, DTMF encode/decode, battery voltage meter, auto power off, battery save and much more. Best of all, it's an ICOM.

IC-T7AHP

MORE POWER!

NOW WITH 4 WATTS OF POWER OUT OF THE BOX

Dual bands (2M/440MHz) at a single bander size and price! Even with lots c features, learning the IC-T7AHP is a sna

NO FUNCTION BUTTON

"'My favorite test is to grab a radio fresh out of the box and measure ho long it takes to access my local repeater – without consulting the manual. For the ICOM IC-T7A my wa stopped at 60 seconds!'"

– QST, *July 19*

Toggle between bands with one touch of the BAND key. Use the thumb "slide-lock" to secure the keypad. Up to 70 memory channels **PC PROGRAMMABL** allow quick access to favorite frequencies and settings. If you get stuc an "intuitive" help functio pops up. Try one today.

For **FREE** Windows™ software, the cloning cable is included with radio.
For CS-DOS cloning software, an optional OPC-474 cloning cable is required.

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Visit your authorized ICOM dealer, or call for a FREE Brochure: (425) 450-6088 Questions? Contact your ICOM dealer, or contact ICOM Technical Support in the HamNet forum on CompuServe® @75540,525 (Internet: 75540.525@compuserve.com). *Receive your FREE Windows™ software and cloning cable for ICOM amateur handhelds when you purchase a new IC-W32A, IC-T7AHP or IC-T2A from a participating authorized ICOM America dealer between October 29, 1997 and March 31, 1998.

ICOM

MIRAGE...100 Watts...$199

Boost your 2 Meter handheld or multimode (like ICOM 706) to a super powerful 100 watts . . . All modes: FM, SSB, CW . . . 15 dB GaAsFET receive preamp . . . Reverse polarity protection . . . Silent cooling fan . . . Free HT-to-amp coax and mobile bracket

In Stock at ham dealers everywhere!

Call your dealer for your best price

$199

B-310-G Suggested Retail

NEW!

Power Curve -- typical B-310-G output power							
Watts Out	*25*	*50*	*75*	*95*	*100*	*100+*	*100+*
Watts In	*¼*	*½*	*1*	*2*	*4*	*6*	*8*

For an incredibly low $199, you can boost your 2 Meter handheld to a super powerful 100 watt mobile or base!

Turn "You're breaking up . . . Can't copy" into "Solid Copy . . . Go ahead."

Talk further . . . Reach distant repeaters . . . Log onto faraway packet bulletin boards.

This rugged Mirage B-310-G amplifier operates *all modes*: FM, SSB and CW. It's perfect for *all* handhelds up to 8 watts *and* multi-mode SSB/CW/FM 2 Meter rigs.

It's great for the ICOM IC-706 -- you'll get 100 blockbuster watts on 2 Meters!

Low noise GaAsFET pre-amp

A built-in *low noise* GaAsFET receive pre-amp gives you 15 dB gain -- lets you dig out weak signals.

Fully Protected

***SWR** Protection* prevents damage from antennas whipping in the wind. *Reverse Polarity Protection* can save your amp if you connect power backwards.

Compact but Powerful

Mirage's integrated *HeatsinkCabinet™* and whisper quiet fan gets heat out fast!

The results? An *ultra-compact* 4¾x1¾x7¾ inch 2½ pound amplifier that delivers a *super powerful* 100 watts.

Free Accessories

Free 3 foot handheld to B-310-G coax cable -- just plug and play! ***Free*** mobile bracket! ***Free*** rubber mounting feet for home use!

Plus more . . .

Automatic RF sense Transmit/Receive switch. Remote keying jack. LEDs monitor "On Air", high SWR, pre-amp, power. Push buttons select SSB/FM, pre-amp, power. Draws 15 amps at 12-15 VDC.

Full one year MIRAGE warranty

With Mirage's legendary ruggedness, you may never need our superb warranty.

Dual Band 144/440 MHz Amp

$159.95 BD-35 Suggested Retail

Power Curve -- typical BD-35 output power							
Watts Out (2Meters)	*30*	*40*	*45*	*45+*	*45+*	*45+*	*45+*
Watts Out (440 MHz)	*16*	*26*	*32*	*35+*	*35+*	*35+*	*35+*
Watts In	*1*	*2*	*3*	*4*	*5*	*6*	*7*

Add this Mirage dual band amp and boost your handheld to 45 watts on 2 Meters or 35 watts on 440 MHz!

Works with all FM handhelds up to 7 watts. Power Curve chart shows typical output power.

Full Duplex Operation

Mirage's exclusive *FullDuplexAmp™* lets you talk on one band and listen on the other band at the same time -- *just like a telephone conversation!* (Requires compatible HT)

Mirage is the Best! Here's why . . .

- ***Automatic frequency band selection*** --you'll never forget to switch bands
- ***Single input connector and single output connector for both bands*** -- easy to use with dual band radios and antennas
- ***First-class strip-line techniques*** -- superb RF performance and reliability
- ***Custom wrap-around heatsink*** -- runs cool
- ***Reverse Polarity Protection*** -- saves your amp if you connect power backward
- ***Automatic RF sense Transmit/Receive switch*** -- makes operation easy
- ***Low input SWR*** -- keeps your handheld safe from overheating
- ***"On Air" LEDs*** -- for each band
- ***Free mobile mounting bracket***
- ***Free 3 foot handheld-to-BD-35 coax cable***
- ***Small size:*** just 5x1¾x5 inches
- ***Full one year MIRAGE warranty***
- ***Legendary MIRAGE ruggedness***

Call your dealer today for your best price!

35 Watts for 2 Meter HTs

B-34-G

$89.95

Suggested Retail

Power Curve -- typical B-34-G output power								
Watts Out	*18*	*30*	*33*	*35+*	*35+*	*35+*	*35+*	*35+*
Watts In	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*

- ***35 Watts Output on 2 Meters***
- ***All modes: FM, SSB, CW***
- ***18 dB GaAsFET preamp***
- ***Reverse polarity protection***
- ***Includes mobile bracket***
- ***Auto RF sense T/R switch***
- ***Custom heatsink, runs cool***
- ***Works with handhelds up to 8 watts***
- ***One year MIRAGE warranty***

MIRAGE RUGGED!

35 watts, FM only . . . $69.95

B-34, $69.95. 35 watts out for 2 watts in. Like B-34-G, FM only, less preamp, mobile bracket. 3⅛x1¾x4¼ inches.

160 Watts on 2 Meters!

B-5016-G

$299

Suggested Retail

Power Curve -- typical B-5016-G output power								
Watts Out	*130*	*135*	*140*	*145*	*150*	*155*	*160*	*165*
Watts In	*20*	*25*	*30*	*35*	*40*	*45*	*50*	*55*

The MIRAGE B-5016-G gives you 160 watts of brute power for 50 watts input on all modes -- FM, SSB or CW!

Ideal for 20 to 60 watt 2 Meter mobile or base. *Power Curve* chart shows typical output power.

Hear weak signals -- low noise GaAsFET preamp gives you excellent 0.6 dB noise figure. Select 15 or 20 dB gain.

B-5016-G has legendary ruggedness. *We know of one that has been in constant use since 1979!*

Heavy-duty heatsink spans entire length of cabinet -- prevents overheating. Power transistors protected by MIRAGE's *Therm-O-Guard™*.

Fully protected from high SWR and excessive input power. Has warning LED.

Has smooth adjustable Transmit/Receive switching with remote external keying.

RC-1, $45, Remote Control. On/Off, pre-amp On/Off, selects SSB/FM. With 18-ft cable.

Draws 17-22 amps at 13.8 VDC. 12x3x5½ in.

More 160 Watt, 2 Meter Amplifiers . . .

B-2516-G, $299. For 10 to 35 watt mobile or base stations. 160 watts out for 25 watts in.

B-1016-G, $379. MIRAGE's most popular *dual purpose* HT *or* mobile/base amplifier. 160 watts out/10 W in. For 0.2-15 watt transceivers.

B-215-G, $379. MIRAGE's most popular *handheld* amp. 150 watts out/2 watts in; 160 watts out/3½ W in. For 0.25 to 5 watt handhelds.

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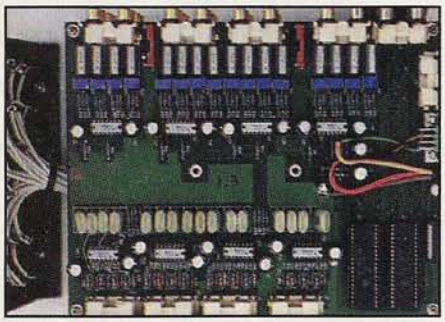
CIRCLE 143 ON READER SERVICE CARD

CQ VHF Ham Radio Above 50 MHz

Volume 3, Number 4—April, 1998



page 16

page 30

page 50

FEATURES

MOBILE SPECIAL

COLUMNS

BASICS

DEPARTMENTS

Next Month: "The 2-Meter Loop Shootout," by Gordon West, WB6NOA

Alinco's Value Leaders Give You More For Less!

▪ DJ-191T 2m HT

Up to 5 watts output, 41 memories, huge display. DJ-190 (no keypad) also available.

▪ DJ-G5T 2m/440 HT

Up to 5 watts output, Channel Scope™, 100 memories/band, CTCSS encode and decode, rf attenuator, 13.8 vdc input port, V/U, V/V, U/U, U/V, programmable 2nd PTT, AM air band receive, full duplex and cross band repeat capabilities

▪ DJ-C1T 2m HT, DJ-C4T 440 HT

"Credit card" size, 300 mw output, 21 memories, lithium-ion battery soft case, quick charger, earphone all included! DJ-C1T also includes AM air band receive.

▪ DJ-S11T 2m HT, DJ-S41T 440 HT

"Pager Size", 340 mw output, 21 memories, uses AA, NiCd or external power, Easy to operate and program, great tx and rx audio, fits in pocket or purse! Check the low price!

▪ DR-150T, DR-150TQ 2m Mobile/Base

50 watts output, 100 memories, Air Band and UHF (440 ~ 450 Mhz) RX, Channel Scope™ display, 2 VFOs, auto dial memories, 9600 packet port, H/M/L output, DR-150TQ includes CTCSS decode.

▪ DR-140T, DR-140TQ 2m Mobile/Base

50/5 watts output, 51 memories, alphanumeric display, AM air band receive. DR-140TQ includes CTCSS decode.

▪ DR-610T, DR-610TQ 2m/440 Mobile/Base

50 watts VHF, 35 watts UHF, Channel Scope™ display, 120 memories, detachable face, V/U, V/V, U/U, U/V, RF attenuator, two VFOs, H/M/L output, AM air band receive, internal duplexer, 9600 packet port, DR-610TQ includes CTCSS decode.

▪ DR-605T, DR-605TQ 2m/440 Mobile/Base

50 watts VHF, 35 watts UHF, 51 memories each band, "set and forget" squelch, UHF TX range of 430 ~ 449.995 MHz allows for satellite work, internal duplexer, 9600 packet port. DR-605TQ includes CTCSS decode.
The value leader in dual band mobiles!

▪ DR-M06TH 6m FM Mobile/Base

50~54 MHz, 100 memories, 20 watts output. Work repeaters or simplex, includes CTCSS encode (decode optional), DTMF mic.

▪ DX-70T, DX-70TH HF+6m Mobile/Base/Portable

160m ~ 6m Amateur Band TX in all modes, general coverage RX 150 KHz ~ 30 MHz and 50 ~ 54 MHz, 2 VFOs, 100 memories, removable face for remote mounting, speech compressor, SSB, CW and AM narrow filters, full, semi or automatic break-in, multi-function control, RIT, TXIT, easy split operation, RF gain, CTCSS for 10 and 6m repeaters. Both models feature 100w output on HF, DX-70TH has 100w output on 6m, DX-70T has 10w output on 6m.

▪ DX-77T HF Desktop Transceiver

160 ~ 10m Amateur Band TX in all modes, general coverage RX 500 KHz ~ 30 MHz, 2 VFOs, internal keyer (6 ~ 50 wpm), 100 memories, 13.8 VDC input, optional computer control capability, CTCSS encoder (front panel programmable), RIT, easy split operation, speech compressor, selectable AGC, large front panel speaker. **The value leader in HF desktop radios!**

▪ DM-340MVT DC Power Supply

30 amps nominal, 35 amps peak, 0~15 VDC variable output, meters included at no extra cost, convenient front panel connections, output connections include binding posts, spring clips and cigar lighter, circuit protection, perfect for base station operation or bench testing.

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Ask your dealer about Alinco's 2-year extended warranty program

When the Infrastructure Crumbles...

Being prepared for emergencies is the heart of ham radio. When "the real thing" happens where YOU live, will YOU be prepared?

For this month's editorial, we pass the microphone again...this time to CQ VHF *public service columnist Bob Josuweit, WA3PZO.*

It's January 7th. I'm walking around in short sleeves, looking at all the antenna work that I should have done over the summer.

Your first thought might be that I live in California or in Florida. The truth is, I live in Philadelphia. Yes, 70 degrees in January with no end in sight to the warm weather. Yet less than 500 miles to the north, sections of New York and New England are coping with the Storm of '98.

Here, a major ice storm has devastated portions of Maine, New York, Vermont, and New Hampshire. President Clinton has declared much of the region a Federal Disaster area. North of the border, in what has been called the biggest disaster in the history of Canada, large portions of Quebec and Ontario are under up to two inches of ice.

Charlie Bliss, KA2UII, reports that, on New York State Route 11, "you can drive for miles at a time and not see any electric poles standing. All of them were either broken off half way up or completely down." According to the ham radio news program, "This Week in Amateur Radio" (TWIAR), "full repair to the infrastructure of electric and telephone utilities, including cellular service and the Internet, is expected to take months."

The Well Runs Dry

As public service columnist for *CQ VHF*, I have come to rely on reports being sent to me via the Internet, receiving news from various lists, and being in contact with you, the reader, and other hams who serve "In the Public Interest." When word of the storm arrived, I started hunting for the latest word from the disaster area. The well was dry. My regular contacts were not there. As I tried to check into various club Web pages, the all-too-familiar error message came: "Connection Timed Out." It was then that I realized just how extensive the problem was. Telephone lines, electrical service, and the Internet were gone! Basic services that we have come to rely on for instantaneous information had failed. It was time for amateur radio to shine!

Amateur radio *did* shine, with local operators supporting local, county, and state government, the Red Cross, Salvation Army, the Weather Service, and other agencies. Hams traveled from other areas of New York and New England to assist their fellow hams and fellow human beings. Others traveled with Civil Air Patrol (CAP) units and Disaster Medical Assistance Teams (DMAT) from Ohio and Kentucky as well as other states. The magnitude of this disaster, and the complete collapse of the physical and electronic infrastructure, should make you look around your own town and wonder, "What if...?"

Getting Across Town

Living near the Delaware River, I think nothing of crossing the bridge to go shopping in New Jersey. But what do you do when the bridge is out? We have covered stories of midwest flooding where two operators were basically within sight of one another, but had to travel 300 miles to cross the closest standing bridge.

In parts of California, hams have earthquakes on their minds. In just a few seconds, bridges can topple, roads can buckle, and highways can become virtually impassable. How do the hams provide communications when the infrastructure fails? One answer is *bike mobile*! That's right! Hams in California and other places are combining cycling with ham radio. After all, bikes can get places that cars can't (this issue features several articles on operating bicycle mobile). In other parts of the country, hams are combining flying and boating with their favorite hobby.

It Can't Happen Here!

"But we've never had a disaster like that," some of you are saying. "It can't happen here!"

Can't it? Last year, the Federal Emergency Management Agency (FEMA) responded to 43 major disasters declared by President Clinton, involving 27 states and three western Pacific island territories.

According to FEMA's year-end figures, nearly a third of the year's declared disasters resulted from only *three* high-impact incidents. These included severe winter storms that lashed five states in the western part of the nation in January; flooding in the Ohio River Valley that devastated parts of Illinois, Indiana, Kentucky, Ohio, Tennessee, and West Virginia in March; and the Red River Valley floods that swamped the Upper Midwest in early April.

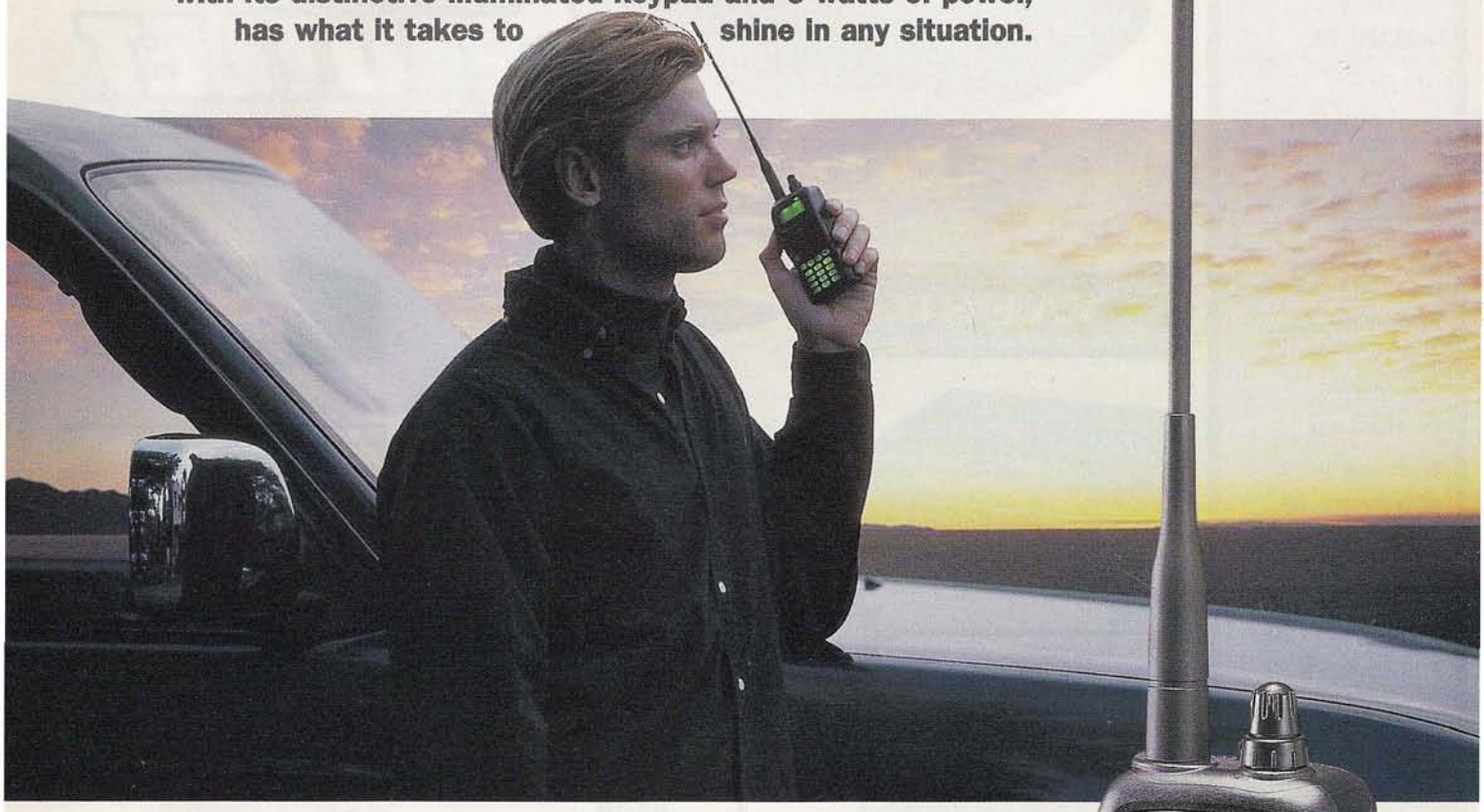
From a cost standpoint, FEMA Director James Lee Witt noted that these three events accounted for $1.04 billion of the more than $1.38 billion in FEMA funds that have been committed to date in responding to the year's declared disasters. Of the agency's overall funding outlay, $450.7 million was spent in recovery aid for disaster-stricken individuals and families, and $708.7 million in assistance to states and communities for clean-up operations, restoration of damaged public facilities, and hazard mitigation projects.

(Continued on page 57)

By Bob Josuweit, WA3PZO (bjosuweit@aol.com)

Look on the brighter side of handhelds

Kenwood's new TH-G71A dual-bander (144MHz/440MHz), with its distinctive illuminated keypad and 6 watts of power, has what it takes to shine in any situation.



TH-G71A 144/440/MHz FM DUAL BANDER

If you're looking for a compact dual-bander with all the right features, yet without the price tag that usually goes with high performance, there's no better choice than the TH-G71A.

Just hold it in your hand and it's immediately clear how well our new handheld transceiver is engineered. The ergonomic design, **illuminated keys** and **backlit display** all combine to make operation a breeze. As does the menu mode, which allows you to customize the TH-G71A by adjusting all major settings to your choice. Besides being easy to use, it also boasts extraordinary power – up to 6 watts (VHF) or 5.5 watts (UHF) of RF output (selectable) with its **high-performance antenna.** The speaker provides **powerful, refreshingly clear audio.**

Of course, power is only part of the picture. Features count. And you can count on the TH-G71A to offer what you'd only expect to find in far more expensive HTs. There are **200 memory channels** – allowing you to store transmit and receive frequencies independently. Memory data can even be edited and stored on your PC. Multiple scan functions are available, including programmable band scan, memory scan with memory channel lock-out, MHz scan and call scan. For each band there are TO (time-operated), CO (carrier-operated) and seek scan resume modes. With the Memory Name function you can choose to identify each channel with up to **6 alphanumeric characters.** DTMF memory and CTCSS tone encode/decode are provided.

The TH-G71A also scores well for stamina and reliability, boasting long battery life – thanks to a variety of power-saving features – and **MIL-STD 810E** compliance for rain & shock resistance. So there's no need to go easy on this dual-bander. It's built better and brighter in every way.

- **6W (VHF), 5.5W (UHF) at 13.8V DC**
- **PC programmable**
- **200 memory ch. with alphanumeric display**
- **MIL-STD 810E (rain & shock)**
- **CTCSS tone scan**
- **Wide-range coverage (incl. aircraft receive)***
- **DTMF memory (10 ch. up to 16 digits)**
- **Multiple scan modes**
- **Key illumination**
- **High-performance antenna**
- **HI/LOW/EL power output selectable**
- **TM-V7A remote control (DTMF remote)**

** Specifications are guaranteed for Amateur Bands only*

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- Collins SSB filter built-in
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- Optional built-in auto tuner
- Remotable front panel, optional kit req.
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FT-11R/41R
2M 440mHz
- 150 Mem. Channels
- 1.5W standard
- 5W option
- Alpha-numeric display
- Compact & back lit keypad

Call For Low Price!

VX-1R
2M/440 Sub-Mini HT
- 290 Memory Channels
- .5W output
- Receives 76-999mHz plus AM BCB (Cell Band Blocked)
- Lithium Ion Battery

NEW!

Call Now For Your Low Price!

$20. Coupon

FT-50RD
2M/440mHz Compact HT
- DVR, Decode, Paging Built-in
- Alpha numeric display
- Wide Band receive
- Battery Saver
- 112 Memories
- Mil-Spec
- HiSpeed scanning

NEW!

Call For Your Low Pricing!

FT-847
Ultimate Base Station, HF, VHF, UHF
- 100w HF/6M, 50w 2M/430 mHz
- DSP • Full Duplex Cross-band
- 1200/9600 Baud Packet Ready

NEW!

Call for Low Intro. Price!

FT-3000M
- 2M 70W Mobile • Wide Band RX
- AM Aircraft RX • Dual Watch
- 9600 Baud Compatible • Alpha Numeric Display

Call For Low Pricing!

$100. Coupon

FT-920 HF+6M Transceiver
- 100w 160-6M, 12VDC
- Built-in DVR, CW Memory Keyer
- DSP, Auto-Notch • 99 Memories
- Computer controllable, CAT System

NEW!

Call For Intro. Low Pricing!

$35. Coupon

FT-8100R 2M/440 Mobile
- Ultra Compact • 50w/35w 2m/440
- 110 memories • Wide Band RX
- Backlit mic • Remotable front panel w/opt. YSK-8100

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VHF News

Gore Uses Ham Radio in Maine

Vice President Al Gore, visiting Maine in the aftermath of the northeast ice storm, talked on ham radio from the RACES (Radio Amateur Civil Emergency Service) station in the Maine statehouse in Augusta. According to the ARRL, Gore spoke to Clarence Rider, AA1PN, in Exeter, Maine, via the 145.850-MHz repeater in Dixmont. The Vice President asked Rider how the storm had affected the residents of his part of the state. Exeter is in a very rural area about 60 miles north of Augusta.

"Please Send Us All Your Hams"

"Ham radio was the lifeline to the outside world for communication" when a January ice storm—one of the worst on record—devastated Northern New England, Northern New York State, and parts of Canada, according to Viv Douglas, WA2PUU. Douglas is the ARRL Public Information Coordinator for Western New York. She told the ARRL that ham radio stations were focal points in the evacuation centers she visited. "When updated condition reports were being given over the ham radio, people would run to cluster around," she said.

Much of the ham communications was on VHF, utilizing FM simplex and those repeaters that somehow managed to withstand the forces that knocked out power and telephone service to vast areas. "Everything was knocked out," Jim Edmonds, WA1KPG, of Syracuse, New York, told the ARRL. "I've never seen a situation where everything was so dependent on ham radio...the first request by the Red Cross and the New York State Emergency Management Office was, 'please send us all your hams'...The guy on the street corner with the handheld saved the day."

Hams were still helping out a month after the storm, according to ARRL Eastern New York Section Manager Rob Leiden, KR2L, who noted that amateurs from around the state "played a key role in...several weeks of round-the-clock activity." By the end of January, however, the FCC lifted a "voluntary communications emergency" that had reserved certain 2-meter frequencies for emergency traffic, and ham radio had resumed a backup and support role after several weeks of being a primary communications resource.

Details of the amateur response to the northeast ice storm are reported in greater depth elsewhere in this issue ("Line of Sight" and "In the Public Interest") and will be the main topic of WA3PZO's "In the Public Interest" column *next* month, when all the information is finally collected.

Hams Get Word Out in Virginia Snowstorm

Emergency management officials in southwestern Virginia turned to ham radio when a surprise snowstorm in late January dumped two feet of snow on the region. Scott County Emergency Coordinator (EC) Jim Flanary, K4LMP, told the *ARRL Letter* that ham radio was the only link between the local Department of Emergency Services and area radio and TV stations. Flanary relayed information and instructions from the DES via an area repeater to hams who still had phone service, and they in turn passed along the information to the local media on what residents should do and whom they should call if they needed help.

ARRL to FCC: Make Band Plans Less Voluntary

The ARRL Board of Directors, at its January meeting, instructed League staff "without delay, to seek a declartory ruling" from the FCC, putting teeth in now-voluntary band plans. The League's petition will ask the FCC to rule that operation which conflicts with the band plans and causes interference "or other adverse effect relative to other users operating in accordance" with the band plans, is not "good amateur practice," and would thus be a violation of FCC rules.

The move came in response to growing numbers of complaints from weak-signal operators and others that FM operation was becoming commonplace in the areas of the VHF bands set aside by the band plans for non-FM operation, and that many FM operators refused to change frequencies "because it's not against the rules."

ARRL Creates Enforcement Task Force

In yet another effort to get the FCC to resume consistently enforcing the amateur rules, the ARRL Board of Directors created an Enforcement Task Force at its January meeting. Headed by Second Vice President (and avid VHFer) Joel Harrison, W5ZN, the panel was directed to "explore any and all means and methods to obtain increased enforcement of the Amateur Rules by the Federal Communications Commission" and to make recommendations to the board for action.

League Supports APRS QSY

The ARRL has added its support to a proposal to move APRS (Automatic Position Reporting System) operations from 145.790 MHz to 144.390 MHz. The goal of the proposed move is to reduce interference to amateur operation from SAREX shuttle missions and the Mir space station on 145.800 MHz, and to put U.S. and Canadian APRS networks on the same frequency. APRS is already using 144.390 in Canada. In addition to voicing support for the move, which has generated pockets of opposition around the country, the League donated $500 to a fund set up to help defray costs of changing frequencies.

KØOV Appointed ARRL Foxhunt Coordinator

Recognizing the growing interest among U.S. hams in Amateur Radio Direction Finding (ARDF)—more commonly known as "foxhunting," "bunny-hunting," or "T-hunting"—the ARRL Board of Directors authorized the appointment of a national ARRL ARDF Coordinator at its January meeting, and foxhunting expert Joe Moell, KØOV, was named to the post. Moell's role will include promoting ARDF in the U.S. and working with the International Amateur

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CQ VHF Ham Radio Above 50 MHz

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Edith Lennon, N2ZRW, Managing Editor
Bernadette Schimmel, Editorial Assistant

CONTRIBUTING STAFF

Gordon West, WB6NOA, Sr. Contributing Editor

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CQ Communications, Inc.
76 North Broadway
Hicksville, NY 11801-2953 USA.

Offices: 76 North Broadway, Hicksville, NY 11801. Telephone: (516) 681-2922. FAX (516) 681-2926. E-mail: CQVHF@aol.com; 72127.745@compuserve.com; cqcomm@delphi.com; WWW:<http://members.aol.com/cqvhf/>. CQ VHF (ISSN 1085-0708) is published monthly by CQ Communications Inc. Periodical postage paid at Hicksville, NY 11801 and additional offices. Subscription prices (all in U.S. dollars): Domestic—one year $24.95, two years $45.95; Canada/Mexico—one year $34.95, two years $65.95; Foreign Air Post—one year $44.95, two years $85.95.

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Radio Union (IARU) to establish a framework in Region 2 (North and South America) for international-style foxhunting competitions similar to what is already established in Regions 1 and 3.

Editor's Note: Even before the League established the position of ARDF Coordinator, Moell began working closely with CQ VHF *on sponsoring a* ***National Foxhunting Weekend****, which will be held this year on April 25 and 26. See Joe's article on page 12 of this issue for further details.*

Phase 3D May Fly in May

European Space Agency (ESA) officials didn't say yes, but also didn't say no, to an AMSAT request for launching the international Phase 3D (P3D) amateur satellite on the Ariane 503 test flight scheduled (at press time in mid-February) for launch next month. The AMSAT News Service (ANS) reported that P3D Project Leader and AMSAT-DL (Germany) President Dr. Karl Meinzer, DJ4ZC, met with ESA officials in January to discuss the possibility.

According to ANS, the ESA officials made no commitments, but said they'd be willing to consider the possibility of a launch on Ariane 503. P3D was originally scheduled to fly on the second Ariane 5 test flight, but was bumped when ESA-mandated structural changes, ordered in the wake of the loss of Ariane 501, couldn't be completed in time for the 502 launch timetable.

AMSAT-NA Executive Vice President Keith Baker, KB1SF, compared the request to going to the airport and getting on "standby" for a fully-booked flight: sometimes, the plane leaves without you, but other times a passenger with reservations doesn't show up. "The strategy often pays off," he told ANS.

AMSAT Lab May Go Commercial

AMSAT is considering taking on commercial clients in order to keep its Orlando, Florida, laboratory operating after Phase 3D (P3D) is launched. Speaking on the 200th Houston AMSAT Net in early January, AMSAT-NA President Bill Tynan, W3XO, said keeping the Orlando lab open will give AMSAT the greatest number of possible options for a follow-on project to P3D, but that the amateur community cannot be expected to support the expense after P3D is launched. He said there have been preliminary discussions with sponsors of a University of Toronto satellite project (which is still awaiting funding from the Canadian government), in which AMSAT participation would result in "a significant financial donation." Tynan's remarks were reported by the AMSAT News Service.

Three Hams Aboard Mir

The Russian Mir space station is now home to three amateurs. The *ARRL Letter* reports they are Cosmonauts Talgat Musabayev, RO3FT, and Nikolai Budarin, RV3FB; and Australian-born U.S. Astronaut Andy Thomas, KD5CHF, who was also given the Australian call-sign VK5MIR for the duration of his stay aboard the space station. Thomas is scheduled to return to Earth in June. He was originally to be the last U.S. astronaut to work on Mir, but a slipping construction schedule for the International Space Station (ISS) has left open the possibility that another astronaut will follow, as both U.S. and Russian officials announced that the 12-year-old Mir would remain "open" until the ISS was ready to begin operations.

VHF Activity from Antarctica

We've received two reports of recent VHF/UHF activity from Antarctica...

Peter Sprengel, PY5CC, in Brazil, reported working Hector, LU1ZC, on Decepcion Island in Antarctica on January 14 on 6-meter CW, after first making contact on 20 meters. "What a pleasure," said Peter in an Internet posting, "to work a new country, a new field and a new continent." A *field* is the large grid square rectangle comprising all grids with the same two letters.

In addition, the AMSAT News Service reports that Ronald Ross, KE6JAB, took a portable digital satellite station with him on a recent trip to the icy continent. He sent over 70 messages, including 16 JPEG images, via the UO-22 and KO-25 satellites. The messages and images were then posted on his Web site at <http://www.thistle.org>. Ron told ANS that his station generated a lot of interest among non-hams at the base camp, especially since his amateur satellite links appeared to be more reliable than the commercial satellite links used for official communications.

Letters

Your Spot to Speak Out

CQ VHF *welcomes comments and suggestions from readers. We'll print a representative sampling each month, and we reserve the right to edit letters for length or style. All letters must be signed and show a return mailing address or valid e-mail address. Writers' names will be withheld from publication upon request. Address letters to: Letters,* CQ VHF, *76 N. Broadway, Hicksville, NY 11801; or via e-mail to <CQVHF @aol.com>; <cqcomm@delphi.com> or <72127.745@compuserve.com>. Please specify that it is a letter for* CQ VHF *magazine.*

APRS Move Disputed

Dear *CQ VHF*:

The "Digital Data Link" column in February issue was filled with errors, distortions, and fabricated statements. The apology that was offered by Don Rotolo, on the APRS mailing list about publication deadlines, does not affect the errors such as 145.790 being an uncoordinated frequency. With a headline of "APRS on the Move" and two explicit statements that it will occur on April 1, it will be read as already being approved. I expect an equal length article based on research in the TAPR archives and conversations with APRS users to be published to correct the damage this column will do. If you want your magazine to be respected, articles such as this must be peer reviewed before publication.

This is the message sent to the column author:

1. APRS is not moving to 144.39 in the Boston area on April 1.

2. Talk to W3IWI about why 145.790 was chosen many years ago.

3. The frequency *is* coordinated by a number of states that do frequency coordination for digital modes.

4. A shift to 145.770 was considered a while ago. That was quashed by the SEDAN network.

5. The North East Weak Signal Group has position statement opposing the move.

6. Check the archives at TAPR for verification of statements 2, 3, and 4.

7. APRS is not changing frequency on April 1.

A very quick read spotted many errors in the article. Where did you do fact checking?

Bruce Pigott, KC1US
Bedford, Massachusetts

Bruce—The presentations made at both the ARRL/TAPR Digital Communications Conference (which Don attended) and the AMSAT-NA Space Symposium (which I attended) certainly implied that all of the major parties involved in both APRS and amateur satellites were in agreement about the move. Don's column had to be in to me by mid-November, and it wasn't until after that—in fact, until after Don's March column was "in the hopper"—that it became obvious that there were pockets of opposition to the proposed change.

The facts of the matter are that TAPR, AMSAT, the APRS software writers and, as of January, the ARRL, are all behind the proposed move. The NEWS Group has not *taken a position opposing the move, as you state above. The NEWS Group's proposed 2-meter bandplan was adopted last summer before the QSY plan was general knowledge. According to NEWS Group officials, the only position that the group has taken is recognizing the long-standing AM calling frequency at 114.400 MHz, and European transatlantic beacons at 144.40–144.41. Where did you do* your *fact-checking?*

Microwave Articles Miss the Mark

Dear *CQ VHF*:

Your February '98 issue was enjoyed in this shack, but sadly, missed the mark in regard to microwave hamming. Y'see, right off the bat, your columnist informs us that little can be done in the microwave range unless we "roll our own." Dear editor(s), you've got to face the fact that most of us are not tinkerers and builders. We're operators. Yeah, I know, I know, some of the amateur fraternity haughtily snort that unless one's got solder flux in one's veins, one's not a "real ham." Well, perhaps these effete snobs'd like to ask the residents of Watertown, New York, whether we "appliance operators" have something worthwhile to contribute. Or ask any of the other four million or so Americans and Canadians whose lives were shattered by the devastating ice storm on the eighth of (January). I suspect you'd find quite a bit of gratitude amongst these folks towards us "appliance operators."

Neighbors, I have an Advanced ticket, and I couldn't turn a schematic into a working rig were my life to depend on it. I was educated as a nurse, not an electrical engineer. I haven't the income to allow returning to school for that missing engineering degree. I would certainly like to get on a frequency above 440, but without fully-assembled rigs ready to operate out of the box, and at a price I can afford, it ain't gonna happen. So—y'all enjoy yer microwave toys—and perhaps, once in awhile, y'can stoop to communicate with us "lower echelon" folks. 73,

Bill Mayers, KG2DI
Lakeport, New York

Bill—Our microwave articles are in no way intended to suggest that anyone who can't "roll their own" is not a "real ham." Our goal is to encourage activity on these bands, which will perhaps result in getting some of the commercial manufacturers to begin building equipment for these frequencies. Until then, the best we can do is share what's out there with those who are *inclined to build and tinker, in hopes that, perhaps, they'll build more than one of whatever they build—after all, they need someone else to talk to!*

Maybe a club would be interested in making a project of getting onto one particular microwave band, with the more technically inclined members willing either to build the gear for everyone or help teach the rest of the members (who are interested) how to do it themselves. It is an unfortunate fact of life that commercial manufacturers in ham radio won't invest in designing and building equipment for which there isn't already an established market. We hope that we can get enough people interested in working on these bands to generate the necessary demand for these products.

Product Update

Rocky Mountain Stainless Steel J-Pole

Rocky Mountain Antennas has introduced what it says is the world's first stainless steel J-pole dual-band antenna. The R.M.A. model JP-2M is a unique 2-meter/70-centimeter (144/440) mobile/marine stainless steel J-pole antenna designed to solve the problems associated with mounting antennas on non-ground plane surfaces, such as fiberglass, RVs, boats, bicycles, motorcycles, wheelchairs, etc.

The JP-2M is constructed from pure stainless steel rods and mounted on black anodized T-16 aircraft grade aluminum. Factory tuning is accomplished through its unique inductive tuning coil, thus increasing gain over conventional feeding. Like an HF mobile antenna, the JP-2M is rigid enough to stay vertical while driving, providing the very best radiation pattern even at speeds over 70 miles an hour. With a spring added, the antenna is flexible enough to slide under trees and garage doors (at reasonable speeds of course). The JP-2M comes with a silver SO-239 with a gold center connector.

The JP-2M (two-element J-mobile) is $59.95. The JP-5B (five-element J-base) will be available in June 1998 and will sell for $69.95. Try it for 30 days and if not totally satisfied send it back for a no-hassle money-back-in-full guarantee. Dealer inquiries welcome.

Rocky Mountain Antennas, 1409 Pine St., Everett, WA 98201; Phone: (425) 303-0684; Orders: (888) 277-4643; Fax: (425) 339-8534.

Circle 100 on reader service card

MFJ-118 Station Clock

MFJ's Jumbo LCD™ 24/12 hour clock has jumbo (1 1/4 inches), high-contrast digits that you can see from anywhere in your ham shack. It displays time in either 24-hour UTC or 12-hour format. It also displays year, month, date, and day of week. Choose from English, Spanish, German or French for 3/4-inch day-of-week display.

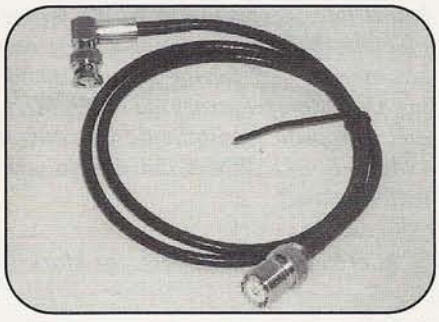
The MFJ-118 has a 100-year calendar and is quartz-controlled for excellent accuracy. Plus, it can be synchronized to WWV. Its sleek black designer case is made of tough scratch-resistant plastic that'll take plenty of abuse. It measures a compact 5 3/4 x 2 1/2 x 1/2 inches. A convenient flip stand lets you place it anywhere on your operating position. Built-in mounting holes make it easy to hang on any wall. The MFJ-118 uses an easy-to-replace AAA battery (not included) that's readily available everywhere.

Suggested retail price for the MFJ-118 is $29.95 with a one-year limited warranty. For your nearest dealer or to order, call toll-free at (800) 647-1800; fax: (601) 323-6551, or write MFJ Enter-prises, Inc., 300 Industrial Park Road, Starkville, MS 39759. Or visit their Web site at <http://www.mfjenterprises.com>.

Circle 101 on reader service card

Cable X-Perts' Three New Cable Assemblies

Cable X-Perts has added three new cable assemblies to its product line. The first one is a three-foot RG58/U coax 95% braid coverage cable with a right-angle male BNC connector on one end (nickel-plated with a Teflon™ dielectric and a gold pin), and a UHF SO-239 connector on the other. Part number is 18240CBS3; price is $14.95.



The second is a three-foot RG58/U coax 95% braid coverage with the same right-angle male BNC connector on one end and a PL-259 connector on the other. Part number is 18240CBP3; price is $14.95. Both of these jumpers help to take the strain off of your handheld's antenna connection.

The third cable is a three-foot RG174/U *miniature* 50-ohm coax with male BNC connectors on each end. Part number is 18216CB3; price is $9.95.

All terminations are soldered and/or crimped (depending on the type of connector) and tested for complete electrical and physical integrity. Prices do not include shipping. No CODs. Minimum order for material is $20.00 plus $6.75 for UPS within the 48 states. For additional information, contact Cable X-Perts, Inc., 416 Diens Drive, Wheeling, IL 60090;. Tech: (847) 520-3003; Fax: (847) 520-3444; Web site: <http://www.cablexperts.com>; e-mail: <cxp@ix.netcom.com>.

Circle 102 on reader service card

PowerPort "PowerSafe" UPS

The PowerPort PowerSafe, by Cutting Edge Enterprises, has everything you need for a 75- to 200-amp uninterruptible power supply (UPS)—except for that old car battery sitting in your garage. There are three DC models designed for light, medium or heavy use. All models come with a heavy-duty, vented battery enclosure suitable for use in the home, triple port automotive cigarette outlets for DC use, and fully automatic chargers. The Deluxe model also provides 500 watts peak AC power (300 watts continuous). Its dimensions (18 x 9.5 x 10.5 inches) are big enough to hold a 125 amp-hour battery, but small enough to fit under your desk at home or transport easily in your car for field use.

At home or in the field, in daily use, as well as during emergencies, this clean, portable unit will keep your equipment fully powered with ample capacity. DC models range in price from $66 to $168. The deluxe AC/DC model is $230.

For extended operations in the field, Cutting Edge has a full line of accessories available as well.

For further information and pricing, contact Roger Hall at Cutting Edge Enterprises, 1803 Mission St., Suite #546, Santa Cruz, CA 95060; Phone: (800) 206-0115; e-mail: <cutedgent@ aol.com>.

Circle 103 on reader service card

Mscan v3.0 SSTV for Windows

Mscan v3.0 is the latest product from CombiTech of the Netherlands. Mscan v3.0 is a completely new program for receiving and transmitting SSTV (Slow Scan TV). It offers all the latest features introduced in Windows 95, and is truly multitasking, allowing you to run multiple programs while monitoring your favorite SSTV channel. Mscan v3.0 also supports simultaneous receiving and transmitting at the same time. And you can enter text and load or save pictures while transmitting .

Mscan also lets you scale the Incoming Video window to any size you want, from a small thumbnail in the corner of your screen, to full screen supports all popular picture formats, including JPEG and Kodak Photo-CD. You can preview any picture before loading it. In addition, built-in TWAIN support means you can import pictures directly into Mscan from practically every video digitizer or scanner on the market.

Mscan features improved synchronization over its predecessor (v. 2.20), plus it will detect the mode, even when you missed the start of the picture. Online help is included for all subjects.

Mscan v3.0 will run on any Windows 95 PC with a P100 processor and Multiscan interface. Drivers for EasyDSP, HariFax IV, and PTC-II are under development. For technical reasons, such interfaces as Miniscan, Hamcomm, Viewport or EasyFax cannot be supported.

A new DOS version of Mscan (v2.21) is also available. It offers an extra repeater option so it can be opened without a 1750-Hz tone, and a special control line is available for use in repeaters that act as transponders. Among other improvements, the new version features centered loading of pictures.

Mscan v3.0 costs U.S. $53 (fl. 95); upgrading from 2.xx costs U.S. $28 (fl. 50). Mscan 2.21 is U.S. $53 (fl. 95); registered users of Mscan pay U.S. $28 (fl. 50). Registered users of Mscan 2.20 can receive the upgrade (to v2.21) for U.S. $6 (fl. 10) or can download the upgrade for free from the company's BBS and Web site.

To order, or for additional information (including Mscan dealers), contact CombiTech, P.O. Box 507, 3235 ZG Rockanje, Holland; Tel/Fax: +31 181 404252 (from the U.S., dial 011 first); e-mail: <combitech@mscan.com>; Web site: <http://www.mscan.com>.

Circle 104 on reader service card

MAXRAD's "Gain With Value" Antennas

MAXRAD, Inc., has introduced a new line of "Gain With Value" mobile antennas that deliver 4 dB or 5 dB of gain for a price only slightly higher than unity gain antennas.

MAXRAD's new MMC molded coil series mobile antennas features high gain (3 dB on VHF and 5 dB on UHF) for a price that's 15% lower than the company's leading chrome-coil series antennas. Models are available to cover any frequency range between 118 and 512 MHz. Either black or chrome finish rods can be specified, and a shock spring is available on all models. The antennas fit any of MAXRAD's ^{3}/4-inch mounts.

Steve Rahn, MAXRAD's Vice President of Marketing and Sales, said "We developed MMC series antennas to meet customer requests for the best of both worlds," low cost and high performance.

MAXRAD, Inc., is a manufacturer of wireless communications antennas. Its product line encompasses over 4,000 base station, mobile and portable antennas, accessories, and mounting items for amateur, cellular, data, GPS, land mobile, OEM, PCS, and SMR applications.

For information, contact MAXRAD, 4350 Chandler Dr., Hanover Park, IL 60103; or call (800) 323-9122, (630) 372-6800; Fax: (630) 372-8077; e-mail: <sales@maxrad.com>; Web site: <http://www.maxrad.com>.

Circle 105 on reader service card

Announcing: The CQ VHF National Foxhunting Weekend April 25–26, 1998

Foxhunts, bunny hunts, T-hunts—you've probably heard about them, but have you ever tried a hidden transmitter hunt? Whether you do it in your car or on foot (or both!), CQ VHF's new National Foxhunting Weekend is the ideal time!

By Joe Moell, KØOV*
homingin@aol.com

If you've never gone on a hidden transmitter hunt, you've missed the best kind of contest that ham radio has to offer. OK, I admit I'm biased, but what other contest teaches technical ability, equipment operating skill *and* detective-like sleuthing?

When you finish competing in a QSO party or grid-square contest, you're not even sure who all of your competitors were, let alone how well you did against them, until months later, when the results come out in a magazine. But when you go T-hunting, you'll know who you're up against and you'll usually know just how well you placed before you go home. After most hunts, there's a lively post-mortem session with plenty of "war stories," either at the hunt location or at a nearby restaurant.

Primal Urges

Some say the urge to locate hidden objects is instinctive. Certainly it's present in hams; we've held transmitter hunts for over 60 years. Originally on 75 and 10 meters, most of the action nowadays takes place on the 2-meter band. Hams in highly populated areas, such as southern California, also hold hunts on the 50-, 223-, and 440-MHz bands. They've even tried it on 1.2 GHz.

Radio direction finding (RDF) techniques are straightforward, but it's far from an exact science. What's more, the "hider" usually does everything possible at every turn to foil the hunters. That challenge is what makes it fun!

To encourage every ham to experience the thrill of the hunt, *CQ VHF* is sponsoring the first National Foxhunting Weekend on April 25–26, 1998. It's not a national contest, just a time for clubs, schools, and Scout groups to try this exciting radiosport. You can show up at any time during the weekend—whatever's most convenient for your group. And there are no set rules, although there are two distinctly different kinds of transmitter hunting to sample: mobile T-hunts and international-style foxhunts. Pick one! Better yet, try both!

T-Hunts—Bearings on a Roll

Since the days when gasoline was less than two bits per gallon, hams have enjoyed mobile transmitter hunting. T-hunts, as we call them in my area, can involve an hour of driving in town or an entire weekend in the mountains and deserts, depending on boundaries and rules of the day.

Photo A. A rotating 2-meter Yagi in a support made from ordinary PVC sprinkler pipe can get you started in mobile T-hunting within one afternoon.

Joe Moell, KØOV, is a professional engineer with over 30 years of experience designing RF circuits and systems for broadcast, communications, and radar. He has hunted hidden transmitters for over 20 years and has written over 100 articles on the topic.

Photo B. This Scout is proud that he has mastered elementary RDF techniques at a Jamboree-On-The-Air campout in Ojai, California. He is using a one-piece receiver-antenna set made in Russia.

Photo C. Steve Sobodos, KN6UX, shows his "game face" just before his turn to start on a southern California international-style foxhunt.

When you start out on a mobile T-hunt, you never know where you'll end up and you never know what you'll find there. You may track down a powerful transmitter and big antenna in plain sight, or you may have to ferret out a postage-stamp sized emitter inside an ordinary soda can or pill bottle. Hidden transmitters have been camouflaged in such unlikely places as the hollow of a tree, the trunk of a police car, a baby carriage at the zoo, and even suspended by a rope under a bridge.

Ham clubs and groups all over the country have 2-meter mobile T-hunts, but they all do it a bit differently. In a few places, the hider sets the rules and they're different for every hunt. Some like to run it like a rally, requiring the winner to have lowest start-to-finish mileage. They say this discourages reckless driving, encourages careful plotting of bearings, and evens out the competition. Sometimes the last team to spot the T is the winner. Everyone starts at the same time from the same place, usually a hilltop.

Other groups simply declare the first finder to be the winner. They say that time is of essence in a jammer hunt or search-and-rescue operation, so RDFers must learn to find transmitters quickly (*This, after all, is the "beyond the fun" aspect of T-hunting, just as nearly everything else we do in ham radio helps prepare us for a serious task.—ed.*). Furthermore, there is no need to worry about the accuracy of odometer calibrations. Some clubs have combined time and mileage scoring in creative ways. Depending on the group's desires, they either all start together or just begin wherever they are when the "T" comes on the air.

In some places, hunts for multiple transmitters are common. In others, one well-concealed rig is enough. Some hunts' rules are strict about antenna polarization, power variations, and nearness to paved roads. Others say, in effect, "Anything goes!" And most of the time it's "every team for itself," but a few towns have cooperative hunts on repeaters where helpful bearings from participants and base stations are welcome.

Getting Started

All you need to put on a beginner's T-hunt is a willing volunteer with a 2-meter radio. That's you? Good! Find an unusual location and start transmitting at the appointed hour. A good time for your club's first hunt is on a weekday evening right after a net, when listenership is high (*or, of course, on our new National Foxhunting Weekend—ed.*).

From your hiding place, make frequent transmissions on the repeater input, urging every listener to get in the car and participate. Declare small boundaries, such as a county or part of it. After a while, you might help hunters by announcing smaller boundaries or giving other clues.

Your club's first T-hunts should be easy so that everyone is successful and encouraged. The signal should be strong and the transmitter should be in plain sight, perhaps in the parking lot of a restaurant or on a table in a city park. Ensure that everyone finds it in a reasonable period of time. Give them a challenge, but not an impossible task. With a few short hunt successes, they'll be eager to try longer range hunts.

With time, your club's hunts will tend to get more difficult as the skills of both hunters and hiders increase. You can move the hunts to a simplex frequency, increase the boundary area and decrease the transmission times to provide a greater challenge. Of course, you should never do anything illegal or make the hunt

"To encourage every ham to experience the thrill of the hunt,* CQ VHF *is sponsoring the first National Foxhunting Weekend on April 25–26, 1998. It's not a national contest, just a time for clubs, schools, and Scout groups to try this exciting radiosport."

Many Ways to Get the Bearing

Mobile direction finding with a beam antenna is easy and intuitive. Just turn the beam for maximum signal, mark your map, and drive in that direction. An old 2-meter Yagi from the flea market may be all you need to get started. Many mobile T-hunters prefer cubical quads over Yagis because of their lower profile on the vehicle. Lightweight VHF quads are easy to build at home with just a few dollars worth of ordinary PVC plumbing parts and wire.

A simple two-element beam (driven element and reflector) is fine for on-foot RDF, but most mobile T-hunters prefer larger three or four-element models because their forward lobes are much sharper. Use your receiver's S-meter to determine peak signal direction when taking bearings.

When you get so close that the meter goes off scale, you must reduce (attenuate) the signal into the receiver without affecting directivity. Simple resistive RF attenuators are the usual choice for mobile T-hunting. They're not as effective, however, for on-foot use with handi-talkies because strong signals bypass the attenuator and penetrate the radio's case. "Offset" or "heterodyne" type attenuators that shift the signal to another frequency at variable level work better in this application.

RDF attachments for your HT are another option. Most have two vertical dipole antennas that are switched by a logic circuit to produce a buzz in the receiver audio. A null in the induced buzz indicates line of bearing, and left/right indicators tell whether the signal is ahead or behind along the bearing line. These add-ons are called time-difference-of-arrival (TDOA) units or phase front detectors. To avoid ambiguous bearings, be sure to select a model that includes left/right indicators, not just a bi-directional tone null. Doppler-type RDF sets with three to eight whip antennas on a ground plane are popular in some cities for mobile T-hunting, but they're not suitable for on-foot use. They're best when tracking strong vertically polarized VHF signals.

World champion European and Asian foxhunters prefer special hand-carried 2-meter RDF sets that consist of a sensitive receiver with a wide-range RF gain control built into the boom of a simple directional antenna. Two-element phased arrays, such as the "HB9CV" and "ZL Special," are often used in these sets because their close element spacing makes them easy to carry. A popular construction technique is to make the antenna elements out of curved steel (like a tape measure), which is less likely to break or cause injuries when crashing through the brush on the run.

Put Your Body into It

Even without a directional antenna, you can get bearings with your handi-talkie or scanner by using the "body shield" technique. Hold the receiver tightly against your chest and turn around slowly, listening for the direction at which your body blocks the signal most effectively (the signal null). At this point, the signal is coming from behind you. Some body shielders walk backwards toward the signal while continuing to listen for the null, while others walk normally in the signal direction for a while and then stop to take another bearing.

When the signal becomes so strong that you can't detect the null, remove the HT's "rubber ducky" antenna and try again. If that isn't enough to knock down the signal, try tuning 5 or 10 kHz off frequency. If your handheld is dual-band or if you're using a scanner, tune to the third harmonic while performing the body shield. The harmonic will usually be much weaker and easier to shield with your body. A small UHF Yagi or quad is easy to carry along for more precise third harmonic bearings.

unsafe for yourself or any hunter. Remember that, if participants don't enjoy themselves or can't trust you to hide in a safe place, they won't come out to hunt for you again.

Radio-Athletes Go for the Gold

In most countries of the world, mobile T-hunting isn't affordable for the average ham. On-foot RDF contesting, called foxtailing, foxteering, radio-orienteering, or ARDF, is much more popular. Similar to sport orienteering, foxtailing takes place in a big woodsy park. There are five or six automatic "foxes" of a 1/2 watt or so, transmitting one at a time in sequence for a minute each. They're scattered on a course which may be several miles long.

Using handheld RDF gear and carrying their orienteering cards, the hunters race off, attempting to be first to find all the foxes. They mark their cards with the special punch or pen at each fox, then sprint to the finish line. They can use maps and magnetic compasses in addition to their RDF gear, but can get no other assistance.

Competitors are started at differing times, forcing them to work independently. In championship matches, judges patrol the hunting grounds. After times are tallied, there are medals and honors for the winners.

Foxtailing is catching on in the U.S. The Friendship Amateur Radio Society (FARS) has been its biggest promoter. FARS has its international headquarters is in Portland, Oregon, with additional chapters in Canada (Victoria, BC), Japan (Niigata, near Tokyo), and Russia (Khabarovsk in eastern Asia). Every two years, FARS sponsors the Friendship Radiosport Games, at which representatives of the four nations get together for a week of friendship and radiosport activities, including a world class foxhunt.

The next Games will be during August, 1999, in Portland. Organizers are working hard to make this foxhunt double as the first International Amateur Radio Union Region 2 (North and South America) ARDF Championships. (*At its January meeting, the ARRL Board of Directors approved the appointment of a volunteer ARRL ARDF Coordinator. At press time, we learned that Joe Moell, KØOV, has been appointed to that post. Congrats, Joe!—ed.*). By getting your

"Some say the urge to locate hidden objects is instinctive. Certainly it's present in hams; we've held transmitter hunts for over 60 years."

Photo D. Being blind doesn't stop Dennis Schwendtner, WB6OBB, from participating in foxhunting. He takes field bearings with a handi-talkie and foil-tube attenuator. The hunt committee provided Linda Reagan, KF6MOB, to act as an Extender (assistant), insuring his safety on this course.

club involved in this popular European/Asian activity, you might help train the next world champion foxhunter!

Watch upcoming issues of *CQ VHF* for news of this championship event and prior qualifying meets. Meanwhile, give the sport a try in your hometown. You don't need a special set of five synchronized foxboxes. For beginners' sessions in my area, I scatter a variety of little emitters in a park or at a club picnic and invite everyone to find them using their handi-talkies, scanners or whatever they have. They are also invited to try out the RDF sets I bring along. Nobody is timed, unless they want to time themselves. It's all for fun and experience.

I've accumulated many little transmitters over the years. No two are alike. They have power levels ranging from 10 milliwatts to 1 watt. Antennas range from 19-inch wires to "rubber duckies" to twin-lead Js. Some have clever voice IDs, others have CW messages at varying pitches and speeds. One has both voice and CW. Some look obviously like a radio, others are cleverly disguised. Almost all are on 146.565 MHz, which is the most popular simplex frequency for sport RDF in the U.S.

Transmit times and cycle rates are all different, so everything is completely asynchronous. The little rigs often jam one another, but that can give clues to observant hunters, too. Sometimes there will be a note at one fox that tells hunters to tune to another frequency for a "bonus" fox. Everyone that tries this has fun. They end up talking at length later about the "personalities" of each fox and the differences between them.

Everyone Can Participate

Foxhunting makes a great activity for young persons. There's no license requirement to receive, so everyone can participate. Try it out with the kids and grandkids of your club members. Once you get the hang of teaching RDF techniques to them, offer the activity to your local Scout troops and schools.

You don't have to be a world-class athlete to be a successful foxtailer. Most of the trophy winners in adult age categories at our local hunts do not run the course from start to finish. There's a lot of walking and pausing out there! If you enjoy the outdoors and the thought of some hiking doesn't scare you, then you have what it takes. If you think you're too old to be wandering in the woods with a radio, then sign up for the fox-building, hiding, timekeeping, and scoring tasks.

See You on the Hunt

Transmitter hunting belongs in the mainstream of amateur radio. Going on a hunt is just as exciting as working new grid squares in a band opening. RDF setups can be as high-tech as a packet network or as simple as a handi-talkie. Ham RDF can be used for public service and to save lives.

Whichever kind of transmitter hunting appeals most to you, give it a try during the *CQ VHF* National Foxhunting Weekend. Afterwards, write up your experiences and send them to me to share with *CQ VHF* readers, just as you would report your score after any other on-air contest. Send e-mail to <homingin@aol.com> or postal mail to Joe Moell, KØOV, P.O. Box 2508, Fullerton, CA 92837. ■

Resources

For more information about mobile T-hunting, see "Foxes, Hounds, and Hams—An Introduction to Fox Hunting," by KB8TEP, on page 12 of the September, 1996, issue of *CQ VHF*.

International-style foxtailing was featured in the October, 1996, issue of *CQ VHF*. See "World-Class Fox Hunting Comes to America," by KØOV, on page 16.

Elementary radio direction finding techniques are discussed in the "Basics" section of the January, 1998, issue of *CQ VHF*, page 81.

Technical information about VHF RDF methods is in the "Repeaters, Satellites, EME and Direction Finding" chapter of *The ARRL Handbook*.

The most comprehensive book for hams on this subject is *Transmitter Hunting—Radio Direction Finding Simplified*, by KØOV and WB6UZZ (TAB/McGraw-Hill #2701). It has 323 pages and 235 illustrations of RDF techniques, projects, and equipment reviews.

The first RDF stop for Internet surfers should be the author's Web site: <http://members.aol.com/homingin/> (don't omit the forward slash at the end). At this URL, you'll find 20 articles on mobile T-hunting and on-foot foxhunting, plus a bibliography of 115 more articles, information on 20 RDF equipment suppliers, and over 110 RDF-related Web links and local T-hunting e-mail contacts.

Ship of Dreams: The NEW Adventures of a Technomad

You may remember seeing and reading about N4RVE's bike-mobile adventures across America as shown on this month's cover. Now, for the first time in print, here are the details of Steve's next venture—on the Microship.

By Steven K. Roberts, N4RVE*
Nomadic Research Labs
wordy@qualcomm.com

It was 1983, in the middle of 8-land...a place of vast cornfields, dreary winters, muggy summers, and suburban sprawl. Bouncing around my mortgaged acre in a blue haze of lawnmower smoke and halfheartedly consulting for local industry, I slowly rankled...why was I doing things I no longer enjoyed to pay for things I no longer wanted? Was this the American Dream? What happened to the grand technopassions that had, not so long ago, kept me up all night in a delicious coffee-wired frenzy of wirewrapping and hacking?

And so, at the age of 30, I hit the RESET button on my life: a "wetware" Control-Alt-Delete. Relationships, real estate, possessions—all faded into memory six months later as I pedaled out of town on the *Winnebiko*, a custom recumbent bicycle carrying a 32-K laptop computer and 300-baud acoustic coupler, a 5-watt solar panel, security system, and camping gear. For 10,000 miles, I wandered America and wrote tales of adventure, slowly realizing that I had stumbled upon something timely and significant: nomadic connectivity.

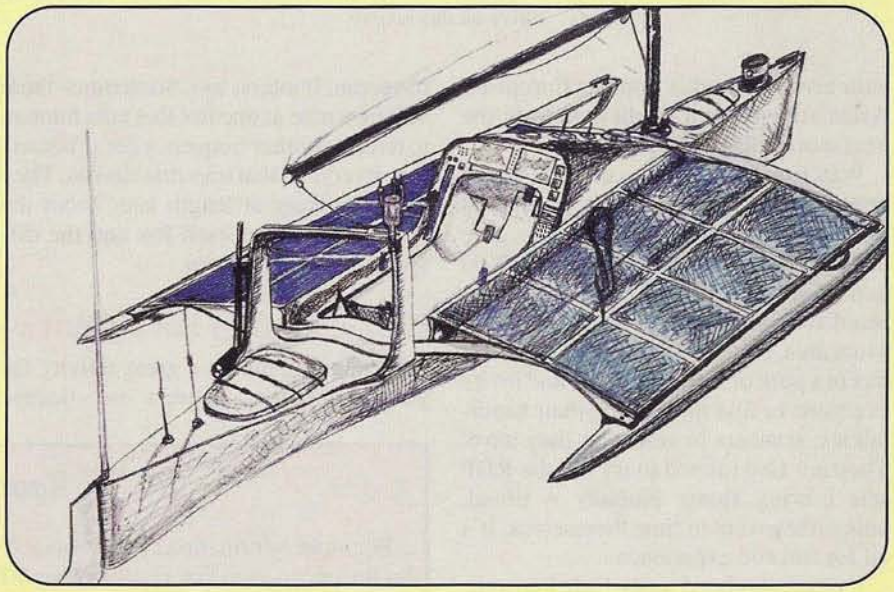


Photo A. Artist's rendering of a completed Microship, a 19-foot micro-trimaran fashioned from a Wenonah Kevlar™ canoe, custom foam-core deck, crossbeams, outer hulls, freestanding sail-rig, pedal drive, and 480-watt Solarex PV array with Minn-Kota electric thruster. Two of these boats and two backpacks are linked via packet radio into a single control and monitoring network. Drawing and photos by Lisa Roberts, KF6NWO; see current work-in-progress photos at.<http://www.microship.com>

But more personally important, the passion had been rekindled, and I wanted more, much more! The *Winnebiko II* was the next logical step; one that offered a level of integration that allowed me to write and communicate while riding. With a binary handlebar keyboard, console computer system with TNC and 2-meter multimode rig, cellular phone with modem, 20 watts from solar panels, and an HF QRP rig in the trailer, I roamed the land with even more freedom than before, typing in ASCII, unconstrained by the availability of phone jacks and AC outlets. Another 6,000 miles floated under my wheels, while inside burbled a Geek's

Steven K. Roberts, N4RVE, has been living out his vision of the American Dream—on the road in hi-tech human-powered vehicles—for the past 15 years. Ham radio has been an essential part of that journey. He and his partner, Lisa, KF6NWO, recently moved their Nomadic Research Labs from California's Silicon Valley to Camano Island, Washington.

"For 10,000 miles, I wandered America and wrote tales of adventure, slowly realizing that I had stumbled upon something timely and significant: nomadic connectivity."

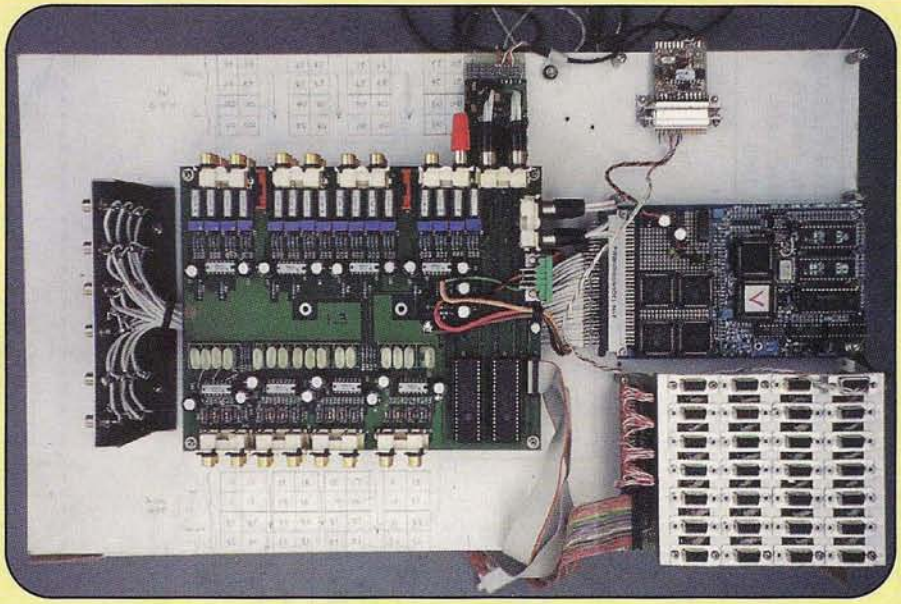


Photo B. Grand Central Station. Large assembly is the 32 x 32 audio crossbar; array of 28 DB-9 connectors at lower right is the serial crossbar; board marked "V" is the 16 x 8 video crossbar with associated FORTH node. Audio and serial units are controlled via parallel ports from the Hub (see "Underground at Grand Central" for technical details).

Fantasy of epic proportions: *BEHEMOTH* (an acronym for *Big Electronic Human-Energized Machine, Only Too Heavy*), shown on this issue's cover.

The megacycle (*shouldn't that be megahertz?—ed.)* rolled out of the bike-lab in 1991, all 580 pounds of it (400 for bike and trailer, 180 for gear). This required a *105-speed transmission* to handle the hills, pneumatically deployed landing gear to stay upright when moving at a crawl, and an active helmet-cooling system to prevent the bio-engine (me) from overheating...technology to compensate for the weight of the technology.

Ah, but the on-board systems! There's a 72-watt solar array, speech synthesizer, ultrasonic head mouse for cursor control, helmet-mounted display, console Macintosh computer, three PCs, a SPARCstation (it's a unixcycle), ICOM IC-725 HF rig with deployable all-band dipole of Outbackers, Yaesu FT-290/790 VHF/UHF multimode rigs with ARR preamps, AEA ATV box, high-speed cellular modem, six-level security system, GPS (Global Positioning System), Qualcomm satellite earth station for continuous Internet connection, and embedded resource management processors... yes, this was indeed a bicycle built to delight the Hacker Within (not to mention the *ham* within). I even clamped a pair of KLM crossed Yagis to the HF mast one evening, aimed carefully, and pedaled slowly down a Silicon Valley avenue chatting bicycle mobile via OSCAR 13 with a chap Down Under.

The only problem was that after 17,000 miles of pedaling, I was starting to gaze wistfully over every sparkling watertop, yearning to be on a boat in a magical place without traffic and hills. And that is why, after accompanying me on over 150,000 miles of speaking tours, BEHEMOTH is moving this fall to the Tech Museum of Innovation in San Jose, California.

The Microship Project

But the road, once begun, never stops, and returning to the illusion of stability was never a realistic option. The past five years have thus seen an asymptotic (*describing a straight line that approaches, but never meets, a curve —ed.*) approach to our ideal substrate for aquatic technomadics: *the Microships*. My partner, Lisa, KF6NWO, and I are now entering the final systems integration phase on a pair of tech'ed-out pedal/solar/sail trimarans with (*take a deep breath*) deployable wheels, satellite net connection, environmental data collection sensors, digital video editing capability, computing and communication systems galore, and the essential suite of navigation tools, not to mention a number of packet and voice links among boats, backpacks, and the outside world.

Putting It in Context

A bit of context is in order before we talk about on-board systems. The objective is open-ended adventure (on the order of years) along coastal and inland waterways, not sailing around the world. Without trailers or other land support, we need to be able to haul out easily for camping or portage, hence the lightweight deployable wheels.

These little 19-foot boats fold from 11 feet to four feet wide for storage or transport, support basic on-water bivouac, and carry the essential life support tools of cooking gear, water filtration, personal foulies, medical supplies, and so on. This combination allows open-ended exploration without the substantial overhead (and limitations) of dependency upon marinas, trailers and tow vehicles, paved launch ramps, and other infrastructure. These are human-powered canoe-scale Microships, not yachts.

How They're Built

The center hull of each Microship (see Photo A) is based on a Kevlar™ "Odyssey" canoe from Wenonah, with deck structure built in our lab of Divinycell foam core, fiberglass, and epoxy. The pilot reclines in a webbed recumbent bicycle seat facing a pressurized control console (I'll explain why later), with helm and system controls convenient to both hands (including hydraulic steering levers, control lines, chord keyboard, pointing device, thruster and power controls, communications console, and so on). This position is optimized for *pedaling*, since a custom drive unit can be deployed to allow human propulsion at about 4 knots via a 12-inch two-blade prop spinning at nine times the pedaling rate.

In addition to running on fish and pizza, the boats can, of course, be sailed, and there's also a steerable Minn-Kota electric motor in each one, delivering 42 pounds of thrust at full power.

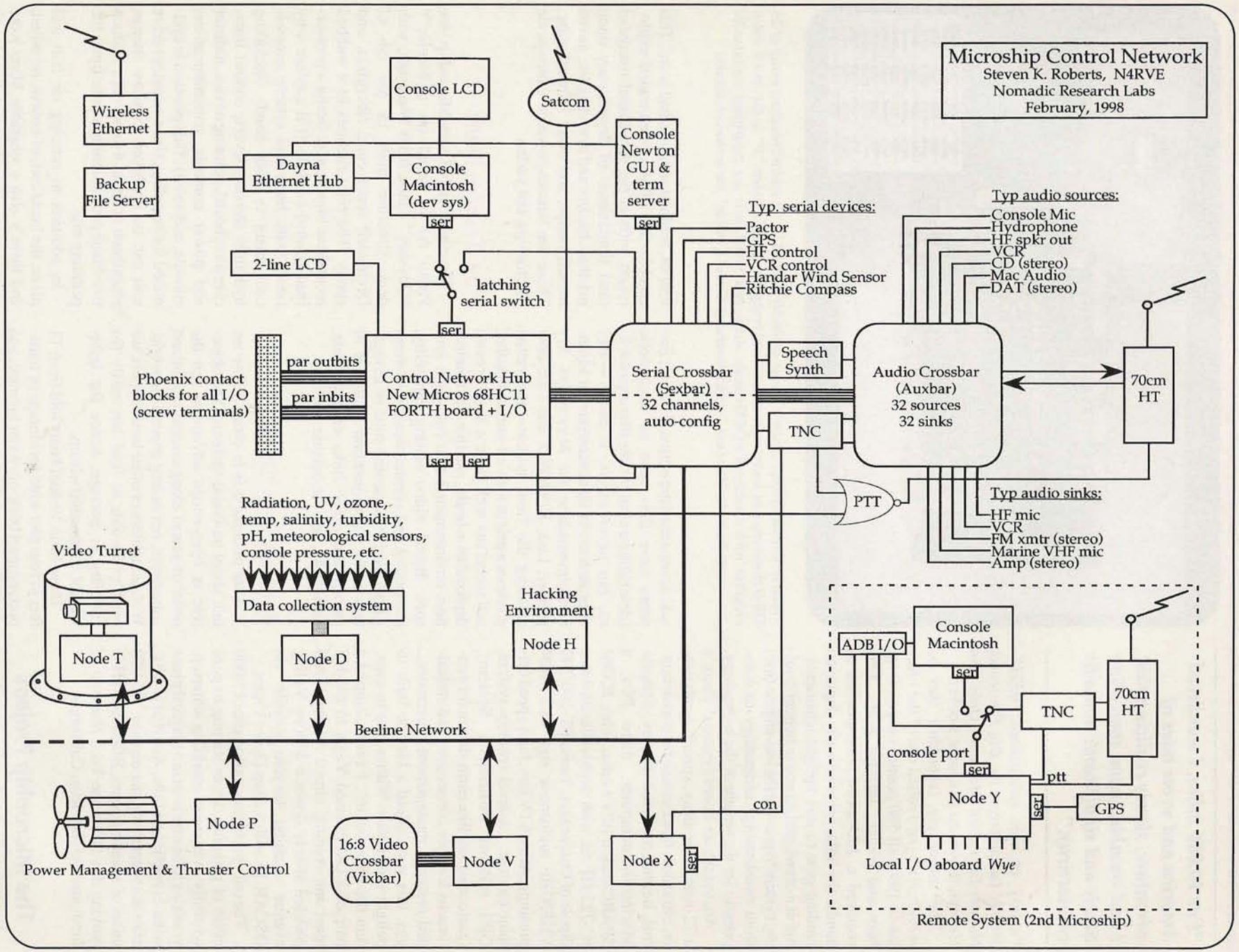


Figure. Microship network architecture (see text).

Underground at Grand Central

As mentioned in the main text, the serial crossbar (Sexbar, at lower right in Photo B) allows four simultaneous bidirectional connections among 32 channels, 28 of which are available as a 4 x 7 array of DB-9 connectors. If the hub controller decides that it wants to send a string from its aux port to the speech synthesizer, for example, it just executes a simple FORTH command (AUX SPEECH SCONNECT) and the result is exactly as if someone had wandered by and plugged in a serial cable, with connections established between pins 2 and 3 of the named connectors. Of course, serial connectors often have their pins swapped from what we expect—how many hours have *you* spent unsoldering and resoldering pins 2 and 3? I worried about this while designing the Sexbar, since the whole idea was to provide enough flexibility to allow new devices to be easily added later.

The solution was a *window comparator*, along with a bit of code that scans the four involved pins on every connect request: if the level is between +/- 2.5 volts, then it's a fair bet the pin is a receiver; outside that range, it's a transmitter. Since we have full switching flexibility through the Mitel 8816 crosspoint chips, it's then a simple matter to conjure a "virtual straight cable" or "virtual null modem cable" as necessary.

The Auxbar, or audio crossbar, subsystem (large board in Photo B) provides the same level of flexibility for our audio sources as the Sexbar does for digital data. It doesn't need to auto-polarity sense, of course, but it does have to maintain line levels through the network to minimize insertion loss and compensate for sources that are hotter or cooler than others. Two stacked PC boards (first developed for BEHEMOTH) each allow up to eight simultaneous connections among any of 16 sources and 16 "sinks." To allow expandability, those eight buses are brought out to the board edge, allowing us to easily scale up the Auxbar to 32 x 32.

One evening, just for kicks, we made a quick setup macro. With one click, the ICOM 725 was commanded via the Sexbar to the NAVTEX frequency, its audio output routed via Auxbar to the KAM+, the resulting serial data piped via Sexbar to the "Audapter" speech synthesizer, and its audio linked to a little Ramsey FM transmitter. We walked around the lab listening to live Coast Guard weather beacons on a Walkman. The whole process only required five lines of code.

Finally, Vixbar, the video crossbar, is packaged directly on a dedicated New Micros FORTH board (right center in Photo B, marked "V"), with four Mitel 88V32 chips allowing any of 16 video sources to be linked to any of eight downstream inputs. Optimized for video, these carry full bandwidth and even allow frame-synchronized switching to minimize screen glitches.

Since our meager weight budget only allows a single deep-cycle battery, which is largely devoted to system loads, we carry rather huge photovoltaic arrays—480 watts per boat of Solarex 30-watt ultralite modules, laminated onto a hinged foam-core substrate that can handle body weight, float, and retract in heavy seas.

In ideal conditions, this 50-square-foot solar array can produce about 32 amps of 12-volt power, enough to push the motor to full thrust. The catch, of course, is that ideal conditions are rare in this environment (rig and console shading, dirt, heat, and other on-board loads thirsty for the same resource), so each boat carries a dedicated power-management processor that takes a snapshot of the whole power system every few seconds, then calculates a "free power" value that's defined, for casual cruising purposes, as maximum throttle. In an emergency, this can be bypassed to yield about two hours of full thrust before the battery is exhausted.

Water Worries... and Wonders

The consoles I mentioned a moment ago are among the most critical aspects of the whole design. BEHEMOTH was loaded with electronics in a "waterproof" console, but it only had to withstand fresh water sprinkling out of the sky. At sea, we have a whole different problem: a pervasive corrosive environment that will ruthlessly attack anything electronic ("Water corrodes. Salt water corrodes absolutely."). To deal with this problem, the consoles are not only sealed, but pressurized to a fraction of a PSI (pounds per square inch) above normal air pressure, allowing a processor to periodically shut

"I even clamped a pair of KLM crossed Yagis to the HF mast one evening, aimed carefully, and pedaled slowly down a Silicon Valley avenue chatting bicycle mobile via OSCAR 13 with a chap Down Under."

off the air supply and check for a pressure drop uncorrelated with temperature change that might indicate a leak.

And all of this exists to allow us to wander the world's waterways, living on the Net, hobnobbing on the airwaves, gathering and posting environmental data, publishing tales, producing videos, and generally frolicking in that strange technomadic domain where bouncing data off a satellite seems a perfectly normal thing to do around the campfire.

Control Network and Resource Management

Now let's take a look at the core of the Microship control network. Bear in mind that we have a huge variety of problems to solve, including audio and video sig-

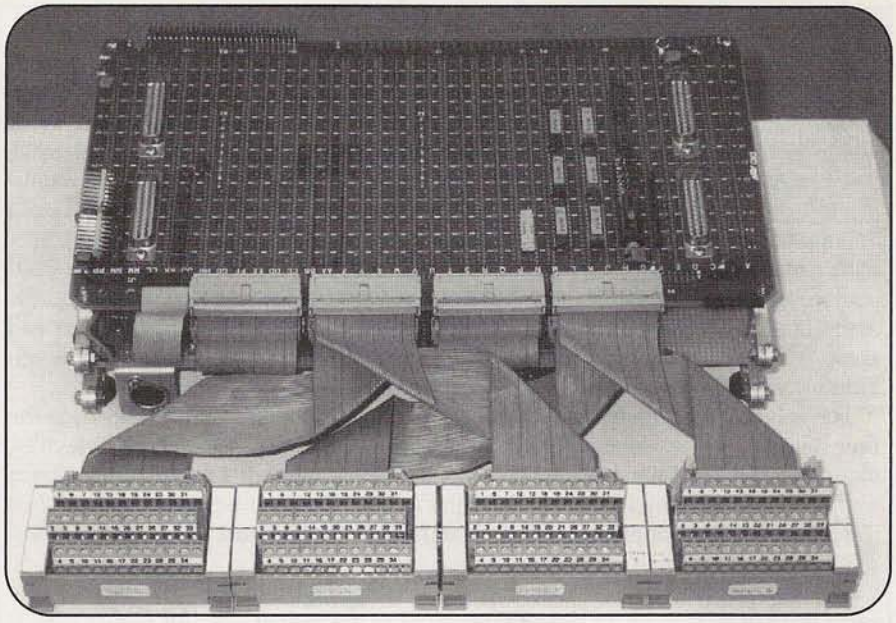


Photo C. The control Hub, comprised of two hinging substrates for serviceability. Phoenix contact blocks in the foreground interface all parallel I/O and power control; small PIC-based circuit on the prototyping board is autonomous scanning "virtual front panel" that displays 48 bit conditions on a console LED matrix (for technical details on the Hub and Beeline network, see "Making a Beeline...").

Making a Beeline...

The Beeline network is a multidrop cable that connects all of the nodes scattered around the ship (see Figure). The "boss" of the network is the *Hub*, a pair of 68HC11 FORTH boards (Photos C and D). It selects a node by sending a single-character node identifier with the high bit set. All notes see this high bit, check to see if they're being called, and then return to whatever they were doing...except the lucky one, which immediately turns on its transmitter to establish a bidirectional link over the Beeline. At this point, the network acts like a straight serial connection between the Hub and the selected node. It's elegant, simple, fast, and easily expandable.

We picked the 68HC11 boards—even though the HC11 technology is 10 years old—because they're very easy to interface and the software for using them is so simple. Plus, the FORTH is in ROM, which lets you bypass the traditional edit-compile-download-debug cycle familiar to anyone who codes in C or assembler language. This is the technology of instant gratification, and, for an embedded control environment, I can imagine nothing more pleasant.

Layered atop the internal FORTH is a pair of tools written for us by Bill Muench. The tight little multitasker and the multidrop network tool takes advantage of the four-wire RS-485 standard. The net effect is straightforward generation of small autonomous tasks, along with the ability to hang up to 128 nodes on a long bus, each of which presents its console port to the upstream machine. (The network cable also carries a NETRESET line to allow automatic cold-start and code reload if watchdogs detect failed nodes.)

Looking again at the Figure, you can see some of the implications of this. The Hub's console port accepts simple ASCII commands from any communications program, so writing a graphic front end is a simple matter of associating transmit strings with various mouseclicks and linking returned data with appropriate graphics, such as a bar graph for temperature. We've done this, with equal ease, in both HyperCard and NewtonScript. The latching serial switch atop the Hub allows the board to reroute its own console to a channel on the Sexbar, making it possible to log in from a distant wireless system and seize control of the network. On reset, it defaults to the console Macintosh to allow recovery from a crash.

nal routing, data collection and reporting, security, power management, thruster control, personal communications, diagnostics, system monitoring, and so on.

While it's often suggested that we install one monster computer with a Web-browser front end and a high-speed communications network encompassing all peripherals, the power demands of such a machine would be way outside our power budget; and most of the serial devices we use are far too "lightweight" to accommodate proper networking via a TCP/IP protocol stack. Also, we theoretically could handle all audio and video streams digitally, but the power cost of that approach in what amounts to a solar canoe is currently unreasonable.

What we really need here is an adaptive Internet-linked control environment that only sucks current when and where necessary, can painlessly interconnect random signals, transparently works as a single system spanning two boats and two backpacks, is easily hackable in the field, and can be viewed by the users at any level from gritty bits-between-your-toes detail to point 'n click pretty pictures. The result, shown in the Figure, has been developed over four years through our own efforts at Nomadic Research Labs, aided by dozens of creative industry and student volunteers.

A couple of key concepts must be understood before the applications make sense: crossbars and multidrop networking. The core of the whole Microship system depends on these two fundamental architectures, which we call *Grand Central Station* (see Photo B) and the *Beeline* network.

Grand Central Station: Sexbar, Auxbar & Vixbar

The three rounded boxes in the Figure give us an immensely powerful, yet simple, tool. Each is a crossbar switching system optimized for one of three signal types: serial (data), audio, and video.

The serial crossbar (Sexbar) allows four simultaneous bidirectional connections among 32 channels, 28 of which are available as a 4 x 7 array of DB-9 connectors. The Sexbar lets the Hub (the master network controller) route any serial data stream to anywhere it needs to go, and we're well on the way to having a universally reconfigurable system (for technical details on the system, see "Underground at Grand Central").

Next door is the audio crossbar (Auxbar), which gives us equivalent flexibility with the surprisingly large number of audio devices on board. Like the Sexbar, this solves a nasty resource management problem: we may want the CD player to go to the speakers, for example, but have one channel automatically overridden by an incoming transmission from the other boat. This completely eliminates the need for multiple heavy speakers, a thicket of dangling microphones, and a nightmare maze of switches and patch cables. Most serious ham shacks could benefit from one of these, but on a tiny boat the need is critical.

The final component in our "Grand Central Station" system, the video crossbar (Vixbar), is at the bottom of the Figure. With six or so cameras scattered around the boats, wireless video links, a Draco Casablanca editing system with 9 Gigabyte hard disk, frame grabber, and remote controlled Sony 8mm VCR, the Vixbar is every bit as useful as its cousins.

Now that we can connect anything to anything under software control, let's take a look at the network itself.

The Beeline Network

We searched far and wide for the ideal hackable, low-power, I/O-rich suite of embedded controllers, and chose the 68HC11 FORTH boards from New Micros as our network control Hub (see Photos C and D; for technical details on the network, see "Making a Beeline"). Things get interesting when the Hub connects itself via the Sexbar to the Beeline network and begins a task called NODESCAN, which hits all the nodes every 15 seconds to update an internal variable table. It can also asynchronously send commands to any node, making the whole thing feel like one machine simultaneously running a vast collection of different tasks involving widely diverse bits of hardware.

The sealed video turret, for example, can point either a zoomable color or IR (infrared)-sensitive black-and-white camera at any angle, or scan between any pair of angles at any speed. The thruster task scales the propulsion system to the available solar power budget. The data collection system busily gathers internal and environmental data for transmission to a Web-accessible database server, and the Hub itself monitors and controls the most critical subsystems (like security and console pressure) since it is always on.

On top of all this, we have a high-level network that includes a terminal server, essentially creating a transparent link between a remote graphic machine via wireless Ethernet and that vanilla ASCII console port that runs the whole show. The problem, of course, is that all this high-level graphic stuff is larger and more power hungry than we need for minimal day-to-day remote backpack operation...so we've added packet radio.

Packnet—A Simple Wireless Network Extension

Did you notice Node X in the diagram? Think of this as "Xternal," as it lets us bring the other boat into the same network environment. Node X gets connected to a PacComm TNC via Sexbar, which is in turn linked to a repackaged UHF HT via Auxbar. Push-to-talk is generated by simple arbitration logic, since we also want to be able to transmit voice, synthesized speech status reports, and other audio over the same radio under Hub control.

"[BEHEMOTH] required a 105-speed transmission to handle the hills, pneumatically deployed landing gear to stay upright when moving at a crawl, and an active helmet-cooling system...technology to compensate for the weight of the technology."

Some distance away, bobbing on the waves, is the other Microship, with a similar TNC and radio connected to the first one (for network purposes, this is Node Y). Node Y's console port is thus linked via packet to the auxiliary serial port on Node X, allowing transparent communication to take place as if it were a hardwired node on the Beeline network (although slower, of course). This brings all the local I/O on the second boat under the purview of the primary control system, effectively linking them into a single network. (Note, by the way, that the pilot of the second boat can override the console connection of Node X in order to directly access local resources.)

Don't Forget the Backpacks!

Not shown in the drawing, but equally straightforward, is the configuration of each backpack. When off the boats, my partner and I need to be able to stay in touch, check status of unattended systems for security purposes, and locate ourselves relative to each other and the boats. Our packs each carry a small 70-centimeter HT, a Mic-E (APRS mic encoder) from TAPR, and a Motorola On-Core GPS receiver, along with a small palmtop computer with a separate high-speed wireless network link.

The Mic-E automatically tails voice transmissions with GPS data and sends the same burst on a scheduled basis if we're not chatting. It also offers a few status bits, giving us the wonderful opportunity to implement a one-button "where are you?" function that prompts the Hub to perform great-circle calculations on GPS data for both packs and both boats, then speak the range and bearing with the synthesizer over the same radio link.

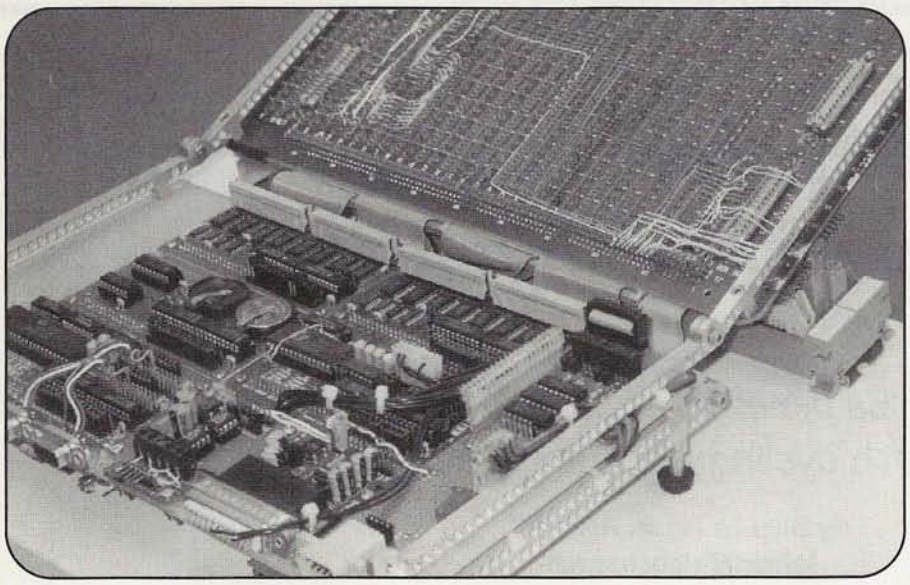


Photo D. The Hub assembly unfolded for access to kluge wiring area and I/O boards. Shown are 64 bits each of parallel input and output, real-time clock, three serial ports, and RS-232 to RS-485 converter driving the Beeline network. The Hub processor itself, a New Micros FORTH 68HC11 board, is mounted to the underside of this panel.

Another button invokes a general system status report, another is an emergency call, and yet another fires up the "big iron" via Hub power control tools to allow a full-scale remote graphic front end that is identical to the one present on the boats' consoles. Plus, a DTMF receiver on the Auxbar adds unlimited, though not particularly intuitive, remote control options to our arsenal.

Project Status

As you can see, the effect of these networking tools is to allow the addition of all sorts of applications and interfaces that may not be obvious during initial design phases. This design keeps up-front hardware development at the very general level of interconnect infrastructure, with applications almost entirely implemented in software. With total control over power switching, general parallel I/O, serial interconnects, audio/video routing, and even the overall network architecture, it's easy to add functionality down the road without spending much time over a hot soldering iron.

At this writing, we're setting up the new Microship lab and home base on Camano Island, Washington. Most of 1998 will be taken up with packaging and test sails in the rich waters of the Pacific Northwest, and, by Spring of 1999, we hope to be launching for our first major adventures: a long drift down the Missouri River from Montana, to be followed by a circumnavigation of the Eastern U.S. on coastal and inland waterways. Stay tuned! ■

Resources

More information is available both digitally and on paper. The Microship project naturally has a Web site, which archives the status reports and offers a variety of related resources and tales. The URL is <http://www.microship.com>.

To automatically receive tech/adventure updates on the project, send an e-mail <wordy@qualcomm.com>, requesting addition to the nomadness list. An update is posted every month or two, and there is no discussion, noise, or commercial activity.

Finally, we have two technical monographs available that may be of interest, each containing full schematics, software listings, component sources, and construction details. NRL-505 gives enough info to clone our video turret; NRL -504 covers all three crossbar systems. These detailed publications are $25 each (plus $4 for domestic shipping) and are available from Nomadic Research Labs, 43730 Vista Del Mar, Fremont, CA 94539-3204. Visa/MC/checks accepted.

Why Put a Perfectly Good Ham Rig on a Bicycle?

A ham cyclist looks at the benefits of combining his two favorite hobbies—benefits to both cycling and ham radio.

By Skip La Fetra, AA6WK*
lafetra@ricochet.net

Why would anyone put a ham radio on a bicycle? Sure, there are a few interesting people who have done some very innovative things, such as Steve Roberts, N4RVE, who built a large computer/radio trailer on his bicycle, which he calls the "Behemoth" (*see this month's cover and Steve's article in this issue—ed.*). But is this really bicycling? Is this really ham radio?

Useful and Valuable

As a bicyclist for 28 years and a ham for seven, I have proven to myself that ham radios belong on bicycles. They're useful and sometimes critically valuable. They're fun and unobtrusive enough that even the most die-hard racing cyclist can easily afford the weight penalty. In fact, I entered the amateur community because I am a bicyclist and saw what ham radio could do for me. But most ham/cyclists I know have followed a different path. They were hams first who became interested in bicycling later.

In this article, I'd like to share with you what excites me about the bicycle/radio combination and, hopefully, get you thinking about joining the fun yourself. I'll talk about:

- Why I find putting a radio on my bicycle to be fun, and what's in it for *you* in your daily routine?
- The bicycle/radio setup. It's actually quite simple!

The author with his "shack on a bike." See text for details of equipment and mounting. (Photos courtesy of the author and BMHA)

- What's in it from an ARES/RACES (Public Service) point of view?
- Personal and public safety.
- Ham radio versus cellular telephones on a bicycle. How are they different and which one should you use?
- The innovative fringe. Want to try bicycle-mobile HF, CW, or packet?
- My own "shack-on-a-bike"

Why "Ham-on-a-Bike" Is Fun

I'm a creature of leisure just like the rest of you. If I'm not having fun, I won't do it. I don't bicycle in the rain, and I am certainly not an "exercise freak." My radio is on the bike because that's where it belongs: it's fun to use and very useful while I am pedaling.

Most of my conversations are social, but I've also arranged a few rendezvous as I've ridden, sometimes with hams I've never met before. I've also started out riding toward areas with different weather and checked the forecast along the way (the weather at the San Francisco Bay can be very different than the weather at points only 30 miles away). And I've used my radio to call for help, both for myself and for others, as well as to telephone home because I'm having too much fun to arrive for dinner on schedule. I rode on Field Day last year and limited myself to only contacts which were made while in motion. My score of less than 10 won't break any records, but I was doing the ride for fun and didn't operate much.

Frankly, I only put my radio on my bicycle because it is useful to have and fun to use. And these two hobbies complement each other nicely. Sometimes I'll ride quietly and just monitor the radio; sometimes, I'll actively chat with friends on the repeater, much as you would do when commuting in an automobile. Other times, I'll seek out other unusual people

Skip La Fetra, AA6WK, lives in Sunnyvale, California. He is the assistant newsletter editor of the Bicycle Mobile Hams of America.

Closeup view of the author's in-the-ear microphone/earphone. He attaches it to his helmet strap with a "hi-tech" paper clip!

to chat with (the simplex calling frequency of 146.520 MHz is good for this). Last summer, I was bicycling through the suburbs while talking with a friend on top of Half Dome in Yosemite National Park (100 air miles away), as he related the previous evening's ham-assisted helicopter rescue. That was a memorable ride, and it wasn't because of the route that I took!

I haven't tried to work the Mir space station while riding, but I do have a QSL card from the NASA special-event station celebrating the 20th anniversary of the Pioneer 10 space probe. I particularly like this card because it doesn't say "special event station" and it appears to be from the space probe itself...plus, it confirms "bicycle mobile." This is DX on a whole new level!

What Kind of Station?

Getting the most out of your bicycle/ham setup takes a bit of preparation, but the rewards are well worth it. Try to answer for yourself the five questions below. If you're not sure of the answers, the BMHA (Bicycle Mobile Hams of America, see "Resources") can help.

- Do I want to use my radio while in motion, or only while stopped somewhere? (I use mine in motion.)
- If it's to be used just while stopped, is a simple HT/rubber duck combination enough? (I use an HT, but with a 1/4-wave whip antenna). If so, then stick the radio in a jersey pocket or handlebar bag and start pedaling.
- If in motion, how do I keep control of the bicycle while using the radio? (The BMHA has zillions of suggestions on this topic.) I use a handlebar-mounted radio and an elaborate but inexpensive setup consisting of a PTT (push-to-talk) switch on my handlebars and an in-the-ear "intra-aural" microphone that is extremely easy to use.
- How will I power my radio? HT battery packs or something more robust? (I use the standard battery packs that came with my Kenwood HT.)
- Will I operate just VHF, or do I want to try HF/CW/packet or other modes? (I'm just a VHF mobiler, on 2 meters and 70 centimeters, and although I have occasionally brought along my packet station, I'm too chicken to type on the keyboard while in motion.)

Public Service Aspects

Not all of us are involved in ARES/RACES or other public service groups, but, here in the San Francisco Bay Area, the next big earthquake is always on our minds. My own town of Sunnyvale, 50 miles south of San Francisco, would be chopped into seven separate areas if the bridges were to fall. Automobiles would be useless, but a bicycle can go anywhere where you can carry it. A bicycle-mobile radio will become a priceless asset when we experience the "big one."

A non-automobile mobile radio is useful in almost any public safety, outdoor, or crowd-control event. In my area, the main events are bicycle tours, equestrian events, and large gatherings in which areas of several city blocks square are closed to automobiles. In each of these situations, it's a real asset for the hams to be mobile, but automobiles are not a viable choice. Putting the ham on a bicycle is the ideal alternative: we have the mobility of motorized traffic, but can thread our way through the densest packing of event-goers. We have the presence of a pedestrian, but the staying power and mobility of the fully-supported vehicle.

The next time you participate in or monitor the next local event, listen for stations reporting in as "Bicycle One" or "Bicycle Mobile Two"—and see what they can do. I'm sure you'll be amazed and impressed.

Personal Safety and Public Safety

But using a radio on a bicycle is a responsibility. You've all read newspaper articles about automobile accidents caused by one or both drivers becoming distracted by a cellular telephone. This is publicity that we don't want in the bicycle community! And an accident caused by inattention on a bicycle can really ruin your day—probably more than an equivalent transgression inside a better-protected automobile.

Ham radio on a bicycle, just like ham radio inside a moving car, can be very safe. You simply need to follow several simple rules:

- Always fasten your seatbelt (OK, this one doesn't apply to a bicycle—I left it here to show just how simple and universal these guidelines are—if you don't have the discipline to fasten your seatbelt

"Last summer, I was bicycling through the suburbs while talking with a friend on top of Half Dome in Yosemite National Park (100 air miles away), as he related the previous evening's ham-assisted helicopter rescue. That was a memorable ride...."

in your automobile, then I don't want to meet you on a bicycle).

• Keep both hands on the handlebars. Your first responsibility is to keep control of your bicycle. If you have a separate speaker-mic or handheld radio, then you have to take one hand off of the handlebars in order to use it. This is fine on city streets, but please stay off the air (and in control of your vehicle) while descending the local mountain roads.

• Your microphone has a dangerous cord. You don't want it to get tangled in your front wheel if you drop it; it's gonna ruin your day if it does. I've used two approaches to reduce the risk:

(1) a microphone cord which isn't long enough to reach the wheel, and;

(2) a cord which is fragile enough that it will break easily if caught and not tangle in the wheel.

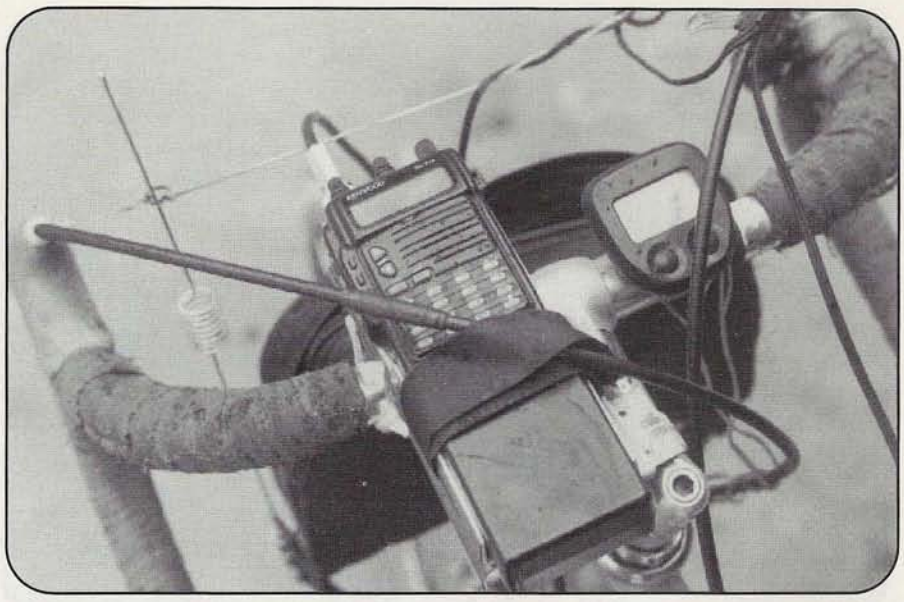
My current choice is Option #2 (with a secure mounting setup at my helmet). Neither of these options has to be elaborate. To shorten my microphone cord and get it in the right position, I've simply taped the middle of the cord to my brake cable above the handlebar—now the mic will dangle an inch or two above the front wheel if dropped. Similarly, my in-the-ear microphone is attached to my helmet strap with a large paper clip.

• Watch your local laws concerning earphones. My state allows you to cover one ear, but not both. In fact, my style of earphone also lets me hear background sounds, so I have "open ears," with one ear augmented by radio speech. "Walkman-style" headphones can be dangerous, not only because they cover both ears but also because their users often turn up the volume to drown out local sounds. Be responsible: you are listening to communicate; not to distract. Communications audio does not need to be loud enough to drown out local traffic noise, and you'll be safer if it doesn't.

• *Have Fun.* You're doing this because you enjoy it. If it isn't fun, you won't pay attention, and you won't be getting or providing any value. Experiment with your setup. Find a relationship with your bicycle and your radio that works for you. I can assure you that it will become a lifelong passion.

Cellphones as a Substitute—Not!

Cellular telephones are becoming incredibly popular. They're easy to use and don't even require an FCC license.



AA6WK's "operating position." The HT is strapped into an old headlight mount, and an external push-to-talk switch is mounted to the handlebars (not visible in photo).

They'll take over what ham radio is doing, right? WRONG! While cellphones have their benefits, they don't match what a ham radio can do, particularly in the RF-difficult areas where many bicyclists like to ride.

A few months ago, I wrote an article for the BMHA newsletter (see "Resources" to get a sample copy) that discussed this topic. It was called "The Cellular Ham" and was later reprinted in several more club newsletters. My points seem to have made a hit with these respective editors, so I'll repeat them briefly here:

• *Safety*—RF from both ham radios and cellphones is not much of a worry. Safety from dropping your microphone into your front wheel is of greater concern and has been covered above.

• *Size and Weight*—Ham radios and cellphones are now small enough and light enough that size and weight are no longer an issue if you're buying a unit specifically for bicycling use.

much *License*—A license is required for a ham HT, but not for a cell phone.

• *Cost*—Cellphone service costs a lot (particularly here in the San Francisco Bay Area, one of the most expensive cellphone markets in the nation). Ham radio service costs nothing, although it is considered good form to join one or more repeater groups and pay nominal dues.

• *Where they work*—Both work in most areas. Both are virtually assured of a connection in metropolitan or high-traffic areas. In the mountains, however, ham radio has the edge because of where hams tend to mount repeaters, and the ham has a choice of target frequencies (and, therefore, locations) to contact, while the cellphone user only has access to the system's antenna towers, usually located along major highways.

• *Emergency use*—The cellphone can dial "911" (which will most likely connect you to the Highway Patrol), while the ham can choose whom to contact. But the ham has to know who to contact, or this advantage is removed.

• Ham radio is "open"—A cellphone is easier, and more private, for calling home, but ham radio is a many-person experience. The whole group can hear what is said (you can call over the mountain with "This is AA6WK, can someone tell me what the weather is like over at the beach?" or perhaps "AA6WK broke a spoke, is there anyone who has an old-style Regina freewheel tool?"). With a cellphone, such inquiries are difficult, expensive, or just plain impossible.

• *Preference*—I ended my article with "your mileage may vary," and you may

"...we have the mobility of motorized traffic, but can thread our way through the densest packing of event-goers. We have the presence of a pedestrian, but the staying power and mobility of the fully-supported vehicle."

Detail of AA6WK's bike-mobile antenna. Note the string about 3/4 of the way up—it stretches from one brake lever to the other and keeps the antenna stable on even the bumpiest roads or trails.

prefer either a cellphone or a ham radio while you bicycle. I am lucky enough to own both, but my cellphone stays home while my ham radio is a faithful companion on my bicycle whenever I travel.

The Innovative Fringe

In my role as assistant newsletter editor for the BMHA, I've seen a number of interesting applications of ham radios and bicycles. I have already mentioned Steve Roberts, N4RVE, and his "Behemoth" bicycle. There are also many BMHA members who take QRP (low-power) rigs into the woods and

"Ham radio is 'open'—A cellphone is easier, and more private, for calling home, but ham radio is a many-person experience."

mountaintops on bicycle tours and have a tremendous time with both the sport of bicycling and the hobby of ham radio. Many of these intrepid souls hang up small solar arrays as they bicycle and recharge their batteries for the next night of calling "CQ."

Several have found handheld transceivers that operate on the world-spanning HF bands and can make contacts several thousand miles away while pedaling along. And a few brave souls have even mounted CW paddles on their handlebars. They don't use a straight key (one of my favorite quotes is "don't use a straight key—you'll sound as if you are trying to send CW while pedaling a bicycle"! How true.) As I mentioned before, I'd even tried bicycle-mobile packet. Your opportunities are limited only by your imagination.

My "Shack-on-a-Bike"

I'm pretty much a low-key radio/bicyclist. Because bicycling is my "first love," I've built my radio setup to match my riding style rather than vice-versa.

In the equipment department, I use a Kenwood TH-77A dual-band HT connected to an in-the-ear microphone (trade name "EarTalk" that I purchased via mail-order). My antenna is a homebrew 1/4-wave whip, but I've also used 1/2-wave AEA "Hotrod" antennas with lots of success. I use the radio's standard battery pack (I carry a spare) and, as I mentioned, my microphone cord is fragile enough (by design) that it will break away in an accident.

How do I mount it all? I used to carry my radio in a handlebar bag, but a few years ago, I decided to carve up an old headlight holder, which now holds the radio mounted nicely on my handlebar where I can see and manipulate it with ease. My antenna mount design is where I was most creative: the base of my antenna is cabled to the bottom of my handlebar bag, and it projects up through a loop in a piece of string which is attached to both brake levers. This provides a soft-but-sturdy two-point suspension to hold the antenna securely, on even the bumpiest of roads, without putting much strain on the radio or the antenna connectors.

What Are You Waiting For?

It's time for you to start riding and hamming. Start now. Have fun. You *can* put your radio on your bicycle, and you *will* have fun. Contact the BMHA and they'll get you started in the right direction. As a local advertising slogan says, "I guarantee it." I hope to see you on the roads and on the air. ■

Resources

More information on combining ham radio and bicycling is available from the Bicycle Mobile Hams of America (BMHA), a world-wide organization of over 400 members. For a recent issue of the group's quarterly newsletter and more information, send a business-sized SASE (Self-Addressed Stamped Envelope) to BMHA, Box 4009-CQ, Boulder, Colorado, 80306. BMHA chairman/founder, Hartley Alley, NAØA, will give you a warm welcome.

Q: I would like to know how a microwave antenna dish works, also the difference between hot standby and space diversity? Also, are there are any books which are easy to follow that talk about digital and analog communications? Thank you.

Zaki Alkhulaitit
(zaki.com@worldnet.att.net)

A: A dish antenna works on receive by collecting signals that strike any part of the dish surface and bouncing them to a central "focal point" above the center of the dish. Here, all of the signals are added together and fed (usually through a preamp) to your receiver. On transmit, it does just the opposite: signals coming from the focal point are bounced off of the dish surface into the air. The size of the dish and the area "illuminated" by the antenna determine its beamwidth.

When I asked one of our technical gurus about easy-to-follow books explaining analog and digital communications, he responded, "That's an oxymoron." That aside, I happen to have the latest Howard W. Sams catalog on my desk, and it includes a book under its Prompt Publications imprint titled, Basic Digital Electronics, *by Alvis J. Evans (ISBN # 0-7906-1118-X). The description starts out by saying the book "will teach you the difference between analog and digital systems...," so it may be just what you're looking for. I haven't read it, so I can't vouch for it personally. You can get more information from the Sams' Web site at <http://www.hwsams.com> or at your local bookstore (be sure to bring that ISBN # with you).*

I asked our microwave columnist, Kent Britain, WA5VJB, to answer your questions about hot standby and space diversity. Here is his reply:

It's very important for Microwave links to be running 99.99% of the time. It's standard practice of each link to have two transmitters and two receivers. The second units are always left on...on "Hot Standby." There are many fault detection circuits on each board. If the Primary unit pops a fuse or pulls the wrong amount of current, everything is switched over to the "Hot Standby" unit in a few thousandths of a second.

With space diversity, the operators of a microwave link will have both transmitters and receivers running all the time. A "voting" circuit picks the link with the best signals. So, if a bird flies by or unusual tropospheric bending occurs on one path, signals switch to the other. Good engineering says the antennas should be at least 10 meters apart or using different frequencies.

—WA5VJB

Q: You have published two articles on grid squares, the first in September, 1997, and the second in February, 1998. They both cover about the same material, but only for the basic grid squares. I would like information on how to determine the subgrids that are used for microwave QSOs. I understand that they are only three miles by four miles in size.

I have an RF CAD program by Gary A. Field that gives the grid square for my QTH as EN44hs. From the articles, the first four digits can be calculated, but not the last two. Can you give me the correct formula to use for determining the last two digits?

73,

Kenneth W. Reetz, KA9PVY
Fall Creek, Wisconsin

A: The information in our "Basics" articles (to which you refer) are intended to provide a "basic" introduction to certain aspects of our hobby. That's why we didn't include the rest of the formula. Here it is:

Go back to the numbers you got that gave you the "44" part of your grid square. Start with the latitude. You used the number just before the decimal to give you the first "4"; now, take the numbers after *the decimal point and multiply by 24. The digit immediately before the decimal in your new product will give you the first small letter, based on 0=a, 1=b,...7=h, etc.*

Now, do the same thing with your longitude figures. Take the product that gave you the second "4" and multiply the numbers after *the decimal by 24. Again, the digit immediately before the decimal in your new product will give you the final small letter, based on 0=a, 1=b,...18=s, etc.*

Working backwards (from your 6-digit grid square), you can calculate your latitude and longitude with the following formulas, with letters A–F representing each of the six grid characters in order:

Latitude = [10B + 1D + F/24] - 90° N. / Longitude =

[20A + 2C + E/12] - 180° E.

So, for grid EN44hs, it'd work out as follows:

Latitude	**= [(10*13) + 4 + (18/24)] - 90**
	= [130+4+.75] - 90
	= 134.75 - 90
	= 44.75 (44.75° North)
Longitude	**= [(20*4) + (2*4) + (7/12)] - 180**
	= [80+8+.583] - 180
	= 88.583 - 180
	= -91.417 (91.417° West)

If your latitude and longitude numbers don't agree with these, then your subgrid must be something different. All of the formulas can be found in the CQ Amateur Radio Almanac.

Do YOU have a question about any aspect of "Ham Radio Above 50 MHz"? We'll do our best to give you a clear, concise answer—or if it's not a question that has just one easy answer, then we'll invite readers to offer their solutions. Send your questions to: Q & A, *CQ VHF* magazine, 76 N. Broadway, Hicksville, NY 11801; via e-mail to <CQVHF@aol.com> or <72127.745@compuserve.com>; or via our Web page at <http://members.aol.com/cqvhf/>. Be sure to specify that it's a question for "Q & A."

Get 100-Plus Mile Mobile Range on VHF Sideband!—Part 1

Here's a practical guide to going SSB-mobile on the "weak-signal" portions of our VHF and UHF bands—and talking farther than you ever thought possible! In Part 1, K1MAP covers the nuts and bolts of putting together an SSB mobile station.

By Mark Casey, K1MAP*
e-mail: K1MAP@juno.com

How many of you have had this happen? You've had a VHF base station for years, and maybe even dabbled a bit in VHF SSB weak-signal work. Every once in a while, you run into a mobile station out there. You think he's going to say, "Oh, I'm just down the road a few miles from you," but no...he's 150 miles away.

It only had to happen to me a couple of times before I started asking some serious questions about mobile operation on VHF. Pretty soon my 25-watt, 2-meter all-mode rig ("all-mode" is usually a misnomer; these radio's most often come with SSB, FM, and CW, but not AM) had a bracket for itself in my van, along with a dedicated 14-inch "halo" antenna mounted on the back of the vehicle. What could I do with this setup? Would anyone be on? More importantly, would anyone hear me? I wasn't sure, but the real fun part was next.

Photo A. The author and his mobile SSB station. His setup was much simpler to start with (one rig and one antenna) and yours can be, too. (All photos by the author)

The First Contacts

"OK," I thought, "let's give it a whirl—get in the van and try a couple of CQs." Local station WZ1V, Ron Klimas, answered my call and asked me if I was a base station. That's one of the best compliments a mobile station can get—being mistaken for a base! Ron was about 40 miles away, not bad for the first try in the driveway. But I figured the true test would be seeing if I could make any contacts while in motion.

My job involves a lot of driving, and that day I had several hours of "windshield time" planned. After a half-hour or so of on-off CQing, a low to moderate strength station answered. It was the late Tom Kirby, W1EJ (now a silent key). Tom gave me a decent signal report and I could hear every word he said, from 120 miles away! Remember, there are no repeaters on SSB...but Tom was running 500 watts and four antennas. Fortunately, similar setups are common among sideband operators, and they will greatly extend the working range of a mobile station by compensating for your generally low power and omnidirectional antenna.

Another great opportunity for mobile operating is vacation time, especially if you're driving through heavily populated areas, such as down the East Coast along I-95 for that winter respite in Florida (I live in New England). My family and I did this about three years ago, and I took full advantage of the drive to wake up every 2-meter sideband station I could between Hartford, Connecticut, and Key West, Florida!

I really started a pileup one evening around Daytona Beach. We were headed

*Mark Casey, K1MAP, lives in Hampden, Massachusetts, and enjoys VHF/UHF/microwave operation from home, mobile, and while hiking. "I love those hilltops," says Mark.

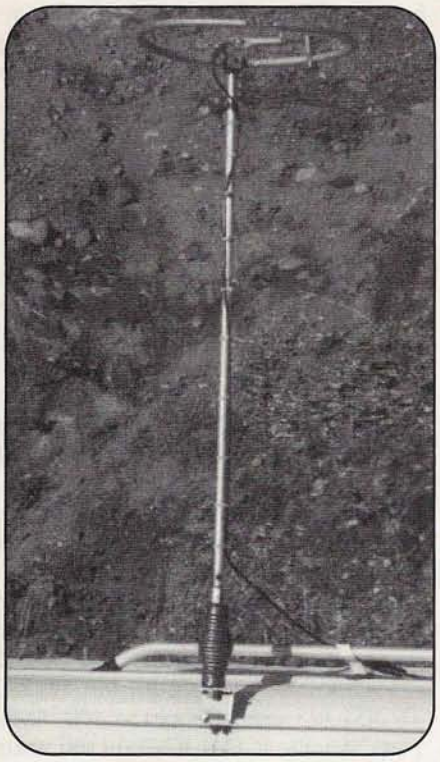


Photo B. The halo and its squared-off cousin, the squalo, are among the best choices for SSB mobile operation. They're available from a variety of sources.

south at a respectable 60 mph, the wife and two kids tired out and snoozing in the back seat. After the requisite CQs, a local station answered, followed by another about 50 miles away, then another about 100 or so miles downstate. The addition of a 150-watt solid state amplifier was worth it. All of these guys could hear me! Even after we moved off the calling frequency of 144.200, and up to 144.210 MHz, this kept going all evening with anywhere from two to five stations in the fray until we arrived in Ft. Lauderdale around midnight.

This has been the story during several winter vacations. My friend Dean, W4WHN, located in the Florida Keys, and I kept nearly every morning and evening sked that we made on 2-meter sideband while my family was vacationing at various places around the Orlando, Tampa, and St. Augustine areas, a stretch of 200-plus miles. Nearly every time I had a little time to operate, a couple of stations would come back to me.

One nice thing about heading south in the winter is that you get summer back, and, in Florida, it comes back with regular tropospheric ducting openings throughout the winter season. The typi-

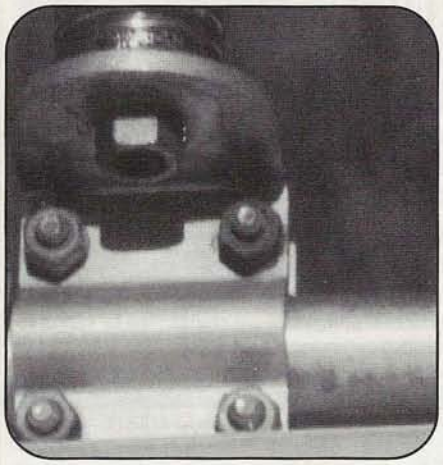


Photo C. RadioShack's mirror and luggage-rack mount is a good candidate for attaching a halo antenna to your car.

cal range of 50 to 100 miles becomes 100 to 200 miles, especially during the early morning, slightly before sunset and for a couple hours afterward.

Planning Your Station

Have I talked you into it yet? Here's another good reason to try SSB mobile on VHF: It's easy to get on, with a wide choice of equipment available for the 6-meter, 2-meter, and 70-centimeter bands. This leads to the first "most commonly asked questions" answer. Yes, you get FM and CW along with SSB on all current model sideband VHF rigs and that feature makes mobile operation even more attractive, since the same radio can hook you up with FM repeaters if you need help or directions. (Properly tuned, most of the antennas we'll talk about soon will perform fairly well in the FM sections of their respective bands too!) There are a couple of older model rigs with SSB only, but these are few and far between. On the other end of the spectrum, the HF/VHF ICOM IC-706 and Alinco DX-70T/TH also have AM!

Now, let's get down to the nitty gritty of setting up an SSB mobile station. Remember, we're not talking about a full-blown rover setup here, just a mobile SSB station for everyday fun. My current setup is shown in Photo A. Let's take first things first and the first two things are: A) Budget, and B) Equipment.

Let's look at B first, then figure out how to make it fit into A. You're going to need a transceiver, mobile mount, antenna, antenna mount, some coax, a power cord, and, if you have a few extra bucks, an amplifier. In the tug of war between budget and obtaining the guts of the project, see if you fall into one of these three categories:

1. *Scrounger*: Search hamfests, swap lists and nets for used rig (single band), parts, etc. Maybe build your own mounts and antenna. Total: $300–$500.

2. *Comfortable*: Used or new rig, maybe for more than one band; purchase mounts, and maybe an amp. You might want to have some fun building your own antenna. Total: $500–$1500.

3. *Hogwild*: New rig(s), more than one band, amplifiers, several antennas. Total: $1500 and up.

OK, you guessed it, I'm a class AAA scrounger, too! If you've got the time, the budget station will perform as well as the store-bought one. The key ingredient here is perseverance in attending hamfests, listening to swap nets, and reading the swap pages in local club newsletters and national publications. In addition, some dealers have great deals on traded-in merchandise, so keep your eyes open.

Which Rig Should I Use?

For those in the scrounger category, the choices are limited to a few older rigs like the ICOM IC-202 (8 watts on 2 meters, USB/CW only), the Yaesu FT-480 (10 watts on 2 meters, SSB/CW/FM), the Yaesu FT-290/first generation (2 watts on 2 meters, SSB/FM/CW), and the KLM Echo II (5 to 10 watts on 2 meters, USB/CW only). Most of these manufacturers also made similar rigs for 6 meters and 70 centimeters.

If you can squeeze into the comfortable group, your choices widen. In the used rig department, add the Kenwood TR-751 (25 watts on 2 meters, SSB/FM/CW) and TR-851 (25 watts on 430 to 440, SSB/FM/CW), the ICOM IC-706 (100 watts on 6 meters, 10 or 20 watts on 2 meters and 100 watts on HF! SSB/FM/CW/AM). In the new rig department, you'll like the single band Yaesu FT-290/RII (2 or 25 watts on 2 meters SSB/FM/CW), the FT-690/RII (2 or 10 watts on 6 meters, SSB/FM/CW), the FT-790/RII (2 or 25 watts on 430-450, SSB/FM/CW) series (*see February's 10-year review on these models—ed.*), Kenwood's TM-255A (40 watts on 2 meters, SSB/FM/CW), TM-455 (35 watts on 430 to 440 only, SSB/FM/CW), and Alinco's multi-band DX70T/TH (10 or 100 watts on 6 meters and 100 watts on HF, SSB/FM/CW).

For those who want to go hogwild, choose any or all of the above, and consider adding 222, 902, 1296, and higher frequency bands. You will need *transverters* for these bands. Downeast Microwave, SSB Electronic, and others make transverters for these bands and others up to and including 10 GHz! A "drive rig" is necessary for transverters. Usually the drive rig is a 2-meter SSB rig that is used as an IF for the transverter and supplies anywhere from 1 milliwatt to 10 watts, depending on the requirements of the transverter. Check space in your vehicle first (maybe you really don't need that front passenger seat)!

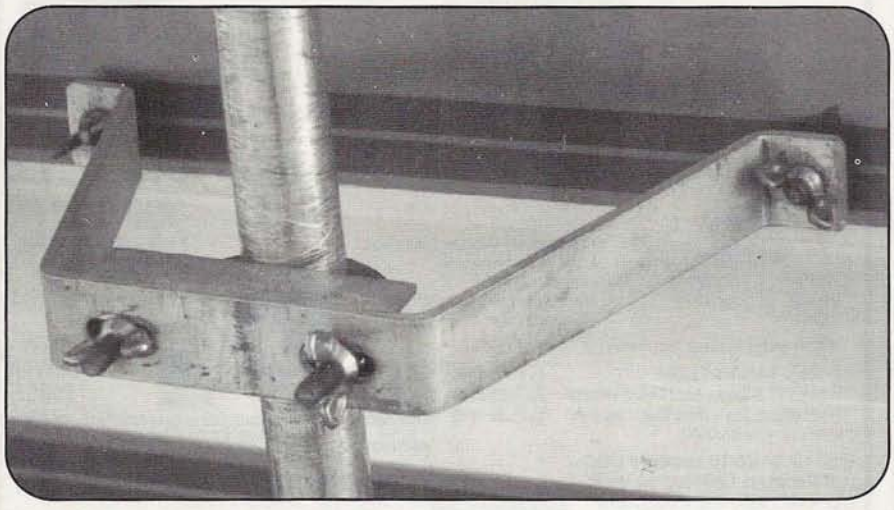


Photo D. Four-inch wall mounts can be used for a serious installation—attach them to a door and you can mount a mast for a beam (see Photo E).

Getting the Signal Out

Selecting an antenna can be tricky. Horizontal polarization works best on

Photo E. If you mount a beam on your vehicle and use it while driving, make sure that it's locked in position and that it doesn't stick out more than 12 inches from the side of the car.

sideband, but may be a bit unwieldy, especially on 6 meters, where the standard halo diameter is 26 inches. You can easily mount these on your vehicle, and they will stand up to even highway speeds. But be prepared for a few funny looks and comments. My favorite one is "Can you talk to the moon?" Answer: yes, if you've mounted an eight-element or longer beam for 2 meters on your ride. (Moon-bounce is technically possible, although you might have to pull over for a few minutes.)

Seriously, the halo/squalo is the best and most durable antenna for any of these bands. The halo is circular (see Photo B) and the squalo is almost square. Both work equally well and take up about the same space. Halos and similar antennas are available from several companies, including KB6KQ, The Olde Antenna Lab, AEA, and M^2. For mounting the halo, RadioShack offers several types of mounts; my favorite is the #21-937, a mirror and luggage rack mount (Photo C). This can also be used as a gutter mount—just don't be afraid of using that electric drill!

"If you've got the time, the budget station will perform as well as the store-bought one. The key ingredient here is perseverance...."

Several hams here in the northeast have constructed simple dipoles for 2 meters with excellent results! If you want to build your own dipole, you'll need a mount (RadioShack or your nearest ham dealer), an aluminum rod of 1/8- to 1/4-inch diameter, and a durable non-metallic post about 20 to 35 inches long, to which you'll attach the dipole and feedline (a hardwood handle with a base spring works surprisingly well). You may not be able to attach the two dipole elements in exactly the same plane, but a difference of 1/2 inch or so will be insignificant.

The third antenna choice, but only for 2 meters and shorter wavelength bands, is the beam. To mount your beam, you'll need a pair of 4-inch wall mounts (Radio Shack #15-883 or similar; see Photo D). Take the inside panel off of the door of your choice—the driver's is the most convenient—and drill four 5/16-inch holes matching the wall mounts for the four 3/4- to 1-inch stainless steel bolts you'll be inserting. Install the bolt head *inside* and add a stainless steel nut to the bolt end that is slightly protruding outside of the door. Tighten up the nut to the max, put the panel back on and use wingnuts to attach the wall mounts. After this, any 1- to 1 1/2-inch medium-weight masting will make a great mount for your beam. (*Your wife wasn't* really *expecting much resale value for that car, was she?—ed.*)

Properly mounted and installed, a two- to six-element 432-MHz beam can be used at highway speeds. A 2-meter beam can be used as well, but just make sure the beam is locked in place so that it doesn't stick out laterally more than 12 inches from the side of your vehicle (see Photo E).

The final antenna choice is the mag-mounted or any standard permanently mounted vertical whip. Your VHF-FM antenna will usually work fine, and you can and will be heard on sideband with a vertical antenna (you can see mine in Photo F), but look for a 10- to 50-mile

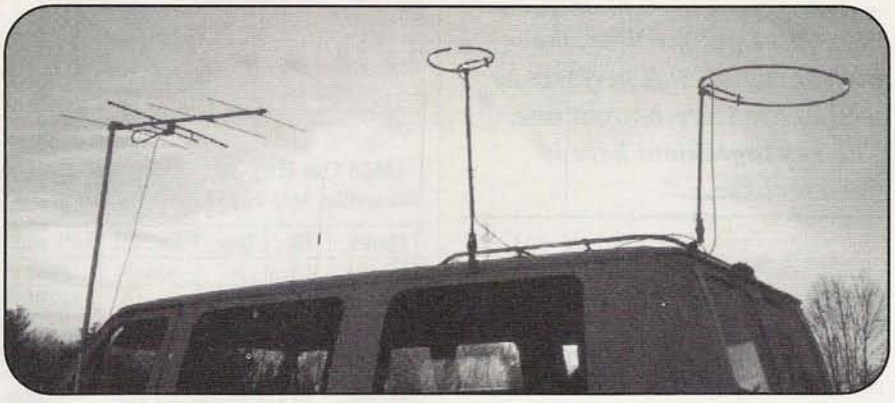


Photo F. While they're less than ideal for SSB work, vertical whip antennas (seen in between the horizontal ones here) can still get you on the air with a decent talk range.

range instead of 50 to 150 miles with the horizontal (due to cross-polarization losses of nearly 20 dB).

Installation Tips

You'll want to run your power lead directly to the battery with an insulated, stranded wire power cable. Use #12 wire for power levels of up to 25 watts, #10 for 25 to 75 watts, and #8 or larger for 75 watts and up, including your amplifier. Both wires should be fused as close to the battery as possible.

A good quality RG-58U stranded-type coax combines the best properties of size and durability for most mobile installations on the 50- through 450-MHz amateur bands. If you have enough room, RG-8X is even better. Avoid sharp bends in the cable, and avoid often-used doors (if you have to run the cable through a door). Keep cable length reasonably short and use good quality connectors. Coax seal or automotive windshield tape make excellent protectors for an outside connection.

PL-259/SO-239s, also (mis)known as UHF connectors, should work adequately at frequencies up to 450 MHz; although, if you feel confident in your abilities in the miniature assembly field, you might try type "N" connectors for 144 MHz and up.

Next, look for a high-capacity battery for your car. A battery with 600-plus *cold cranking amps* (CCA) and a *reserve capacity* of at least 80 minutes will increase the likelihood of your car starting the next morning after leaving the radio on all night. A recent check at the local warehouse store found an 875 cca/165-minute reserve capacity battery for my truck priced at only $48.00! Look closely at battery specifications, as there are many types and the rating is much more important than warranty length. If you've got a few extra bucks and some room under the hood, a spare battery is a good investment also.

More Power, Larger Ears and the Extras

Do you *need* an amplifier? No, you can do a lot on VHF sideband with only 10 watts, but most mobile ops with room in the budget go for the standard 100- to 170-watt "brick" amplifiers to increase their range to a sensational level! Used price for one of these is in the $100 to $200 range, and new can run you $200 to $400. If you get hooked, an amplifier in this range will be a valued investment. Amplifiers fit nicely under front seats or in the trunk compartment, behind the rear seat. Remember to leave at least one inch of air space above and around the amp for temperature protection.

How about a receive preamp? Since cable lengths are short in mobile installations, the only preamps you'll find worthwhile are the ones already in the rig. or build into an amplifier. When you're shopping for an amp, it's worthwhile to pick one with an internal preamp.

An amplified speaker is also a very good investment. Many of those distant stations that would have been part of the road noise using the stock speaker can be heard very well using an external amplified speaker.

Operating SSB Mobile

Once you've got your mobile VHF sideband station set up, it's time for some fun on the air! But we're just about out of room, so we'll cover the operating end of the picture in Part 2. Between now and then, you can work on putting your SSB mobile station together! ■

Resources

The equipment suppliers mentioned in this article may be contacted as follows:

Rigs & Transverters

Alinco USA, 438 Amapola Ave., Suite 130, Torrance, CA 90501; Phone: (310) 618-8616; Fax: (310) 618-8758; Internet: <http://www.alinco.com>.

Downeast Microwave, Inc., 954 Rt. 519, Frenchtown, NJ 08825; Phone: (908) 996-3584; Fax: (908) 996-3702; Internet: <http://www.downeastmicrowave.com>

ICOM America, Inc., 2380 116th Ave. NE, Bellevue, WA 98004; Phone: (425) 454-8155; Internet: <http://www.icomamerica.com>

Kenwood Amateur Radio Products Group, P.O. Box 22745, 2201 E. Dominguez St., Long Beach, CA 90801-5745; Phone: (310) 639-5300; Internet: <http://www.kenwood.net>

SSB Electronic USA, 124 Cherrywood Dr., Mountaintop, PA 18707; Phone: (717) 868-5643; Internet: <http://www.ssbusa.com>

Yaesu USA, 17210 Edwards Rd., Cerritos, CA 90703; Phone: (562) 404-2700; Internet: <http://www.yaesu.com>

Antennas

AEA Division of Tempo Research Corp., 1221 Liberty Way, Vista, CA 92083; Phone: (800) 258-7805 (Orders only); Tech support: (760) 598-9677; Fax: (760) 598-4898; Internet: <http://www.aea-wireless.com>.

KB6KQ Antennas, c/o Norm Pedersen, KB6KQ, 70 Arrowhead Dr., Carson City, NV 89706; Phone: (702) 885-7885; Fax: (702) 841-1880; E-mail: <KB6KQNORM@aol.com>.

M^2 Antenna Systems, Inc., 7560 N. Del Mar Ave., Fresno, CA 93711; Phone: (209) 432-8873; Fax: (209) 432-3059; Internet: <http://www.m2inc.com>.

Olde Antenna Lab, 41541 Dublin Drive, Parker, CO 80134; Phone: (303) 841-1735; Fax: (303) 841-1354; E-mail: <w6oal@aol.com>.

Hamfest Calendar

The following hamfests are scheduled for April, 1998:

April 1, 10-70 Repeater Assn., Annual Electronic Auction, VFW, **Clifton, NJ**. Talk-in: 146.70 (-). For information, call the 10-70 Hotline at (201) 445-5172.

April 3–4, Annual Hamfest, Sherwood Forest Convention Center, **Sherwood, AR**. Talk-in: 146.940-. For information, contact J.C. Smith, N5RXS, (501) 568-7982.

April 3–4, 7th Hamfest, Albertville Recreation Center, **Albertville, AL** Talk-in: 147.200, alternate 145.10. For information, contact Marshall County Amateur Radio Club, P.O. Box 2811, Albertville, AL 35950, or call Buddy Smith, KC4URL, (205) 593-2516; e-mail: <kc4url@airnet.net>. (exams)

April 4, LARC Fest, Boulder County Fair Grounds, **Longmont, CO**. For information, contact Fred, KBØUUD, (303) 678-5830, or e-mail: <frecon.piz@juno.com>. (exams)

April 4, Hamfest & Computer Show, Northern Lebanon High School, **Fredericksburg, PA**. Talk-in: 146.04/64. For information, contact Lanny Hoffman, KD3TS, 337 N. 19th Street, Lebanon, PA 17046 or call (717) 274-2148. (exams)

April 5, 26th Annual Hamfest, NCS ARRL Convention & Computer Fair, Jim Graham Bldg., NCS Fairgrounds, **Raleigh, NC**. For information, contact Wilbur Goss, WD4RDT, 4425 Watkins Rd., Raleigh, NC 27616, or call (919) 676-4697. (exams)

April 5, 26th Annual Swapfest, John Q. Hammons Trade Center, **Middleton, WI**. Talk-in: MARA repeater, W9HSY 147.75/15. For information, contact MARA, P.O. Box 8890, Madison, WI 53708-8890, or call (608) 245-8890; Web site: http://www.cs.wisc.edu/~jeremyc/mara/swapfest/>.

April 5, Framingham Flea Market and VEC Session, Framingham High School, **Framingham, MA**. For information, contact Bev Lees, N1OO, FARA P.O. Box 3005 Framingham, MA 01705, or call (508) 626-2012. For exam info., contact Dick Marshall, K1KTK (508) 887-0563. (exams)

April 5, 38th Hamfest, Tall Cedars of Lebanon Picnic Grove, **Hamilton Twp., NJ**. Talk-in: 146.67(-). For information, contact (609) 882-2240 or <www.slac.com/w2zq>; or Hamcomp '98 DVRA, P.O. Box 7024, West Trenton, NJ 08628.

April 10–11, Hamfest & Computer Expo '98, Trace Convention Center, **Tupelo, MS**. Talk-in: 147.38, call KC5OBD, ragchew 145.49. For information, contact Jack Ellis, KI5QV, Rt. 4, Box 198-B, Tupelo, MS 38801; or phone (601) 842-7255 or <www.tupelofest,org>. (exams)

April 11, 52nd Annual Hamfest & Computer Fair, Comanche County Fairgrounds, **Lawton, OK**. Talk-in: 146.91-offset. For information, contact Bob Morford, KA5YED, 1415 NW 33rd Street, Lawton, OK 73505; call (580) 355-6120; e-mail <w5ks@rli.net>.

April 11, Hamfest, Bentonville National Guard Armory, **Bentonville, AR**. Talk-in: 145.290- repeater. For information, contact BCRO, P.O. Box 883, Pea Ridge, AR 72751.

April 18, Hamfest '98, John Q. Hammons Convention Center, **Joplin, MO**. Talk-in: 147.210+. For information, contact Andy Gabber, KAØTUD, e-mail: <agabbert@hotmail.com>. (exams)

April 19, Smartsfest '98 & Hobby Electronics Show, Canterbury Park, **Shakopee, MN**. For information, contact SMARTS Inc., P.O. Box 144, Chaska, MN 55318; Fleamarket/Advance Tickets, call Helen at: (612) 361-6782. (exams)

April 19, Spring Hamfest & Computer Show, Elk's Lodge, **Cedar Hill, MO**. Talk-in: 147.075 or 147.105. For information, call Jim, KAØWXN, (314) 296-3473. (exams)

April 19, Hamfest & Computer Show, Hawthorne Race Course, **Stickney, IL**. Talk-in: 145.250. For information, contact DARC Hamfest '98, 7511 Walnut Ave., Woodbridge, IL 60517; Web site: <http://homepage.interaccess.com/~geirh/>. (exams)

April 19, 39th Blossomland Blast, St. Joe Kickers Sport Club, **St. Joseph, MI**. Talk-in: 146.82-, 146.72- and 146.52. For information, contact Blossomland Amateur Radio Assn., 1051 Main Street, St. Joseph, MI 49085, or call (616) 982-0404, Mon–Fri. 10 a.m.–6 p.m. or Sat. 10 a.m.–1 p.m. (exams)

April 24–25, Hamfest and State Convention, Little Rock Expo Center, **Little Rock, AR**. Talk-in: 146.850(-). For information, contact Chairman Jim Blackmon, 1008 Pine St., Arkadelphia, AR 71923-4919, or call (870) 246-6734; Web site: <http://www.aristotle.net/~n5xay/lrh98.html>.

April 25, Springfest '98, Cattle Building, NY State Fairgrounds, **Syracuse, NY**. For information, contact Robert Hamby, W2WRH, 4196 Lucan Rd., Liverpool, NY 13090, or call (315) 622-1068.(exams)

(Hamfests continued on page 82)

Southeastern VHF Society Conference

April 3–4, Southeastern VHF Society Technical Conference, Atlanta Marriott Northwest, between Atlanta and Manetta, GA. For details, see last month's Hamfest Calendar, or visit the SVHFS Web page at:<http://www.akorn.net/~ae6e/svhfs>.

Operating Notes

For April, 1998:

5	Good EME Conditions
13	ARRL Spring Sprint, 144 MHz (see rules, this issue)
21	ARRL Spring Sprint, 222 MHz
22	Lyrids meteor shower peak
25–26	**CQ VHF National Foxhunting Weekend (see article this issue)**
26	Good EME Conditions
29	ARRL Spring Sprint, 432 MHz

EME data courtesy W5LUU. More contest info is available on the CQ VHF *Web page at:* <http://members.aol.com/cqvhf/navhfcon.htm>.

What You've Told Us...

The responses to our January survey on band plans were very encouraging. Nearly all of you (93%) are at least somewhat familiar with the band plan(s) for the band(s) on which you operate—45% are very familiar and no one circled "What's a band plan?"—and virtually all of you (95%) do your best to operate in accordance with the band plan(s) in your area.

Most of you don't see a major interference problem in your area due to non-compliance with the band plans, with 41% saying they're not aware of *any* problems and 44% saying interference is a slight or moderate problem. Only 3% say it's severe. On the other hand, over 70% of you say you've personally encountered, at least once, interference problems due to poor band plan compliance.

What should be done? The majority of you (53%) feel better education is the key to improved compliance, with 20% favoring FCC rulemaking and 17% leaning toward peer pressure. Thankfully, only 1% answered "survival of the fittest."

Interestingly, while only 20% felt that FCC rulemaking was the best way to deal with the problem, only 15% said "leave the rules as they are." A near-majority (47%) said the FCC should recognize and urge compliance with ham-established band plans (essentially what the ARRL is asking for; see "VHF News"), while 22% feel the FCC should *require* compliance, and only 16% feel that band segments should be set aside, in the rules, for each mode.

As always, thanks for your responses. This month's winner of a free one-year subscription to *CQ VHF* is Dale M. Rohwer, Jr., of Fairbault, MN.

CQ VHF Ham Radio Above 50 MHz

Reader Survey—April, 1998

We'd like to know more about you...about who you are and where you live, about the kind(s) of work you do, and about your ham radio interests and activities. Why? To help us serve you better.

Each month, we'll ask a few different questions and ask you to indicate your answers by circling certain numbers on the Reader Service Card and returning it to us (we've already paid the postage).

And, as a bit of an incentive, we'll pick one respondent every month and give that person a complimentary one-year subscription (or subscription extension) to CQ VHF. *This month, in line with our mobile special, we'd like to find out how much you get up and around with your ham gear. (We'll get back to the demographics soon).*

	Circle Reader Service #
1. Please indicate how often you operate mobile (all forms of transportation). Select only one.	
Exclusively	1
Regularly	2
Occasionally	3
Never	4
2. Please indicate the form(s) of mobile operation that you regularly use. Select all that apply.	
Car (or other passenger vehicle)	5
Truck/Van (work vehicle)	6
Bus/train	7
Bicycle	8
Boat/ship	9
Airplane	10
On foot	11
Other	12
3. Please indicate the band(s) on which you operate while mobile. Select all that apply.	
6 meters (50–54 MHz)	13
2 meters (144–148 MHz)	14
1.35 meters (222–225 MHz)	15
70 centimeters (420–450 MHz)	16
33 centimeters (902–908 MHz)	17
23 centimeters (1240–1300 MHz)	18
2304 MHz &/or higher	19
4. Please indicate which mode(s) you use while operating mobile. Select all that apply.	
FM	20
SSB	21
AM	22
CW	23
Packet (except APRS)	24
APRS	25
Satellite	26
ATV	27
Other	28

Thank you for your responses. We'll have more questions for you next month.

The Effects of Moon Phase on EME Signal Strength

Why do some moonbounce stations manage to make contacts even under poor conditions while others have no luck at all? K7JA shares his theory of the effects on EME of lunar phases and parabolic reflections from crater rims.

By Chip Margelli, K7JA*
e-mail: k7ja@dxer.com

It's well known to VHF/UHF EME ("moonbounce") operators that signals reflected off the moon go through predictable variations during the moon's 27-day orbital period. This article will attempt to provide an explanation of the physical and propagational forces that cause this effect. Suggestions will also be made as to potential station design steps which might provide consistent signal strength on any calendar day.

Signal Strength vs. Moon Phase

As a general rule, EME signal strength tends to peak around the time of "Full Moon." As seen in Photo A, this is when the full surface of the moon is available for reflection. At "First Quarter" or "Third Quarter" moon phase, though, signals are weaker. Inspection of Photo B shows the rather obvious reason: only half of the moon's surface is now available for reflection. Accordingly, from the changing of the moon phase alone, we would predict a signal degradation of 3 dB. As the moon phase approaches the "Crescent" stage (Photo C), EME paths become almost impossible, to the point—at "New Moon"—where most signals disappear into the background noise and EME basically cannot be utilized as a communication mode.

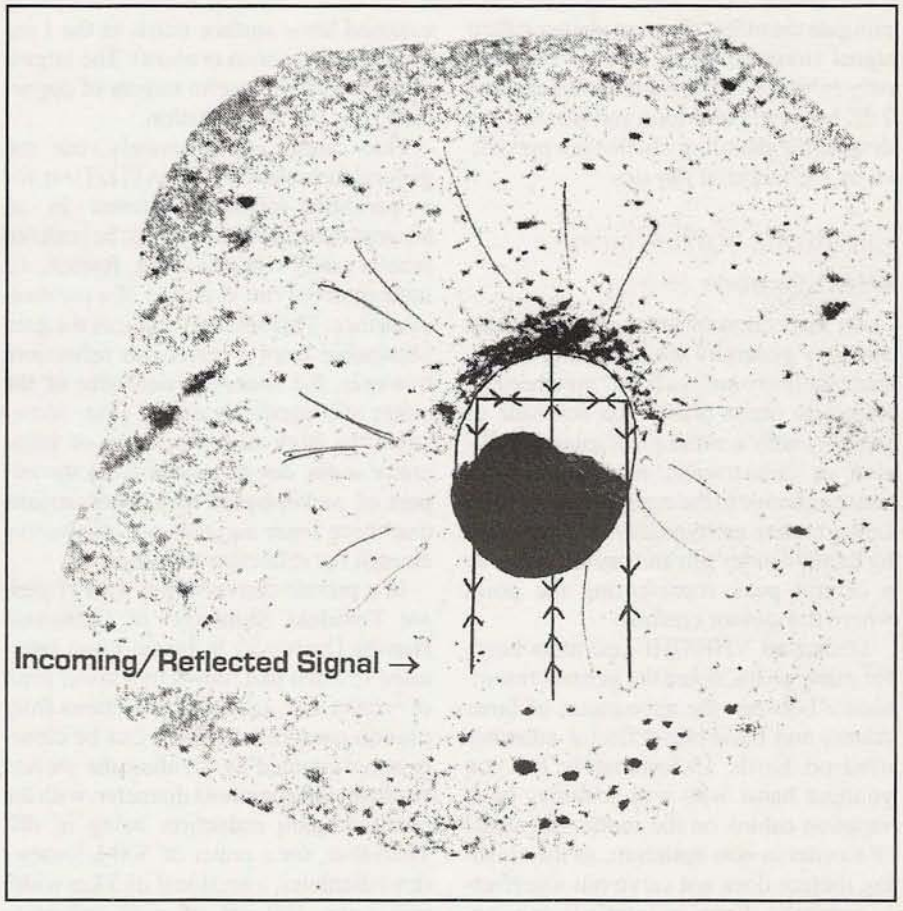


Figure 1. Pseudo-parabolic surface of lunar crater rim is suitable for reflection of narrow-beamwidth signals.

However, the relationship between signal strength and moon phase does not follow a precise plane-geometry pattern, for two reasons. First, the moon is not a flat plane, but rather is a spherical object. Secondly, this sphere is not perfectly flat, but is pockmarked by thousands upon thousands of craters of varying size. This latter characteristic, as we will see, is often used by the best EME operators to

*Chip Margelli, K7JA, is an active HF, VHF, and UHF DX and contest operator and the Manager of the Engineering/R&D Department at Yaesu U.S.A. Chip and his wife Janet, WØMF, live in Garden Grove, California.

Photo A. Full Moon—100% of moon's surface available for reflection, making EME contacts easier.

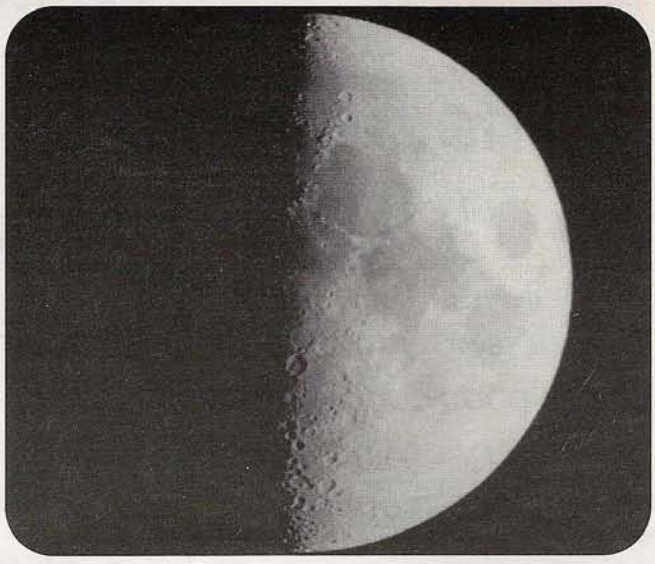


Photo B. First Quarter Moon—only 50% of surface available. EME contacts are more difficult.

mitigate the effect of moon phase on their signal strength. These stations typically only exhibit a signal degradation of about 2 dB between Full Moon and New Moon, despite the daunting challenges presented by the world of physics.

Parabolic Reflection from Crater Rims

An inspection of lunar craters reveals that they generally are uniformly round, since there are no localized "weathering" effects to cause erosion on one side or another; only a subsequent meteor collision or catastrophic moonquake will cause a change in the crater's appearance. Lunar craters are typically distinguished by a round outer rim and occasionally by a central peak representing the point where the meteor crashed.

Dedicated VHF/UHF operators have, for many years, noted the general resemblance between the appearance of lunar craters and parabolic-reflector antennas used on Earth. Unfortunately for you younger hams who will someday have vacation cabins on the moon, the shape of a crater is non-optimum, as the crashing meteor does not carve out a perfectly parabolic shape; a crater's floor is approximately flat. However, the outer wall of a lunar crater more closely approximates a curved surface which might be utilized for reflective purposes (see Figure 1).

When the sun angle is low on the lunar horizon, it's easy to see a number of craters near the eastern or western rim of the exposed lunar surface (such as the Langrenus or Furnerius **craters**). The largest of these provide useful targets of opportunity for our investigation.

One cannot, unfortunately, use the general formula ($G = \{[4\pi A]/[\lambda^2]\} \cdot \eta$) for a parabolic-reflector antenna in an attempt to estimate the gain to be realized from a crater-rim reflection. Rather, we must treat the rim as a *slice* of a parabolic surface. This severely reduces the gain obtainable from a crater-rim reflection; however, the sheer physical size of the crater still produces useful gain. Moreover, the high nickel content of lunar crater walls, due to residue from the impact of nickel-based meteorites, means that these lunar surfaces are conductive enough for reflective purposes.

In a private conversation with Professor Tokidoki Shimbun[1] of Getsumen Hansha University in Japan, I was interested to learn that, down to a lower limit of $^1/_{200}$th size, sectional reflections from pseudo-parabolic surfaces can be closely approximated by dividing the section width into the parabola diameter, with the resultant gain reduction being in dB. Therefore, for a crater of 500-kilometer (km) diameter, a sectional of 5 km width will have 100 dB of gain reduction (5/500). But if we look at the tremendous gains available from such huge surfaces as crater rims (≥300 dB), it is obvious that useful gain is obtainable from craters with rims even 2 km high (crater diameter: 100 km).

A further complication can arise, unfortunately: the "shadowing" effect of any central peak in the center of the crater floor. Because of the narrow beamwidth used for crater-rim reflections, a tall central peak could, in principle, block the entire incoming signal. It's my opinion that slight movement in the antenna array may well be the source of so-called "Libation Fading"[2] as the signal beam accidentally brushes against the top of a crater's central peak. Choosing a crater devoid of a central peak will, of course, eliminate this potential complication.

The final effect to be considered regarding crater-rim reflections is the non-uniformity of the reflective surface. Analogous to "surface error" in a metallic parabolic dish, this degradation factor has been found to average 30.5 dB for lunar craters.

Station Design for Consistent EME Signals

It is obvious that certain stations are able to work EME at almost any moon phase, despite the massive path degradation differences which exist between Full Moon and New Moon. What are these operators' secrets? What allows them to keep making QSOs when single-Yagi stations are only successful around the time of Full Moon?

Photo D shows the 432-MHz EME array of Gerald Williamson, K5GW. This array consists of 640 elements, based on 16 bays of 4 x 10-element Yagi antennas. It's a massive engineering achievement. One might attribute Gerald's consistent signal to the sheer physical size of the

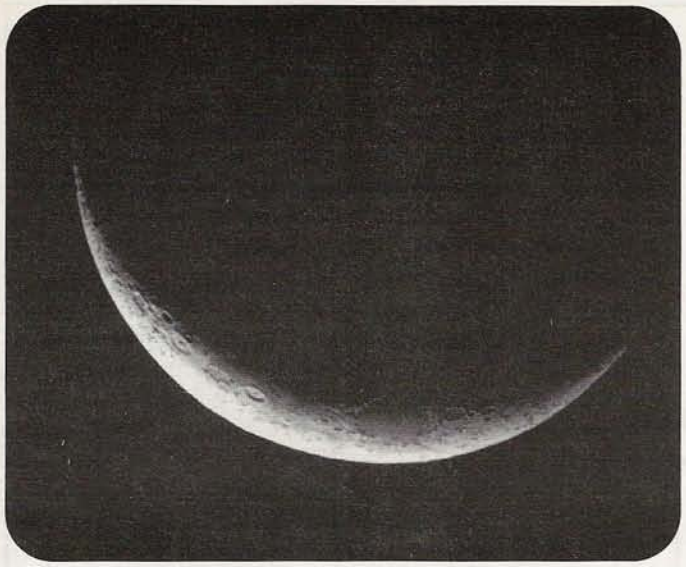


Photo C. Crescent Moon—EME communication is very difficult with such a small portion of the moon illuminated.

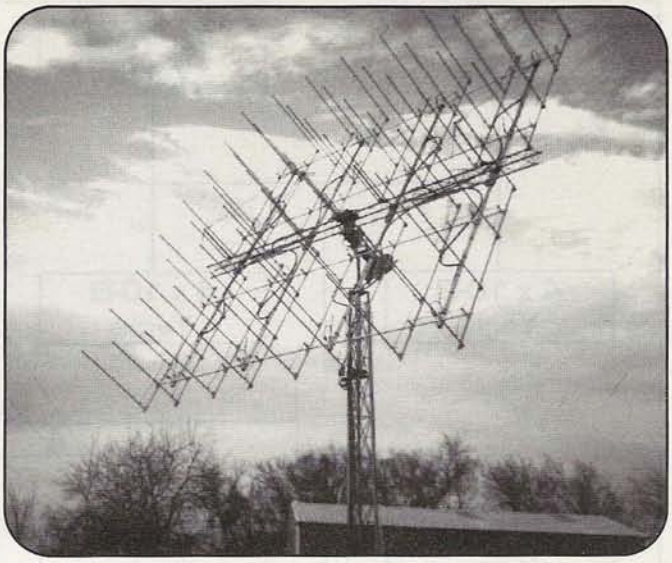


Photo D. K5GW's 640-element, 432-MHz EME array, responsible for Gerald's consistently loud signals off the moon. (Courtesy K5GW)

array; however, a fixed array size does not account for the signal degradation caused by moon phase. Indeed, something else appears to be at work.

Although Gerald will not confirm this, many now believe that he and other successful EME station owners have devised a sophisticated switching network for their arrays, utilizing each box of 4 x 10-element Yagis as a "building block" for the system. In a nutshell, they use only a single box of four antennas at Full Moon, when the entire moon is available for reflection. At first- or third-quarter moon, a second box of four Yagis is switched in, making up the 3-dB path degradation. As the moon loses another 50% a few days later, the array size must again be

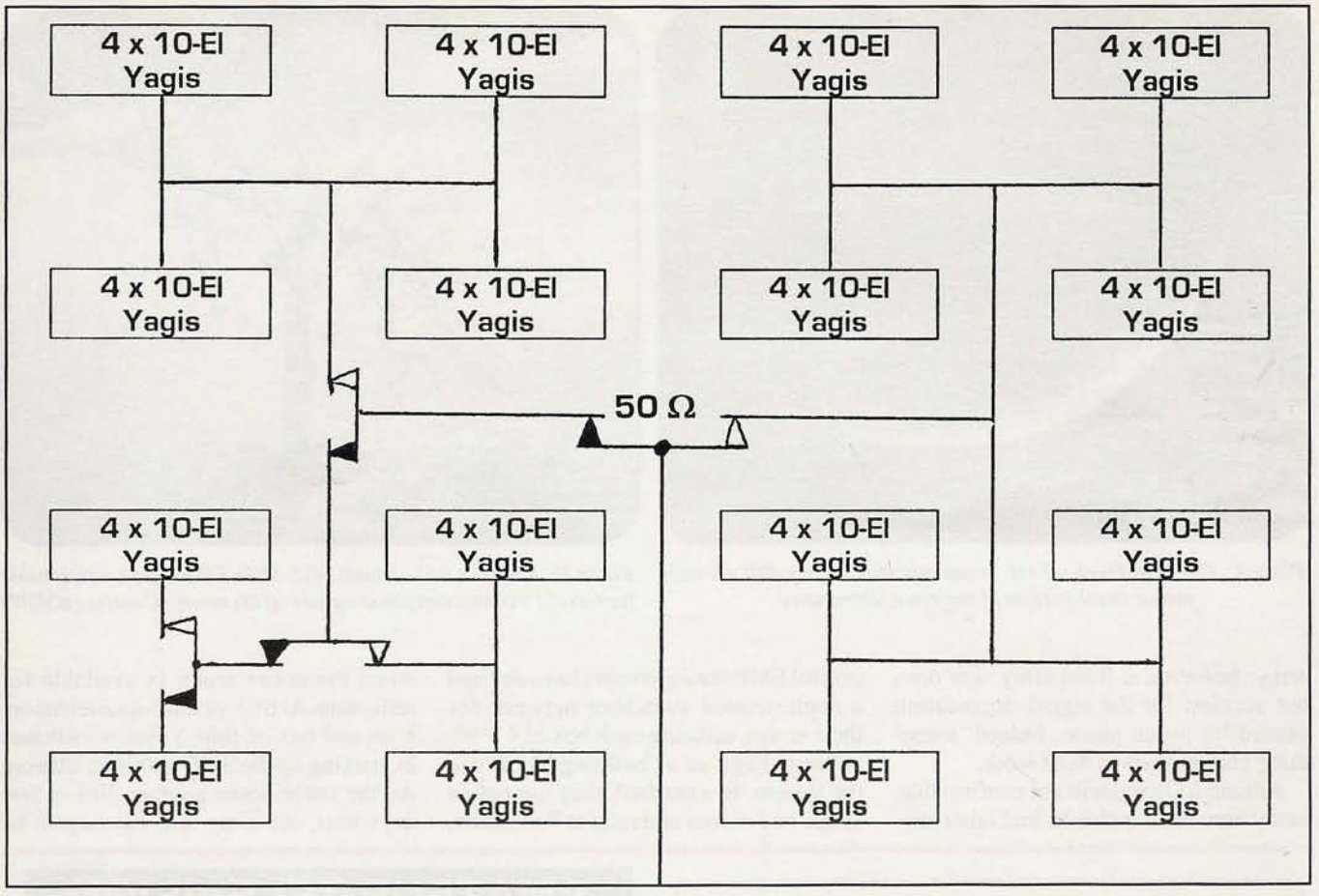


Figure 2. Simplified diagram of relay-switching system for 640-element array, allowing crater-rim-reflection mode.

doubled, so two more boxes of four Yagis are added. This process continues until the operator runs out of antennas. Budgets, physical space available, and the strength of support structures and rotators are usually the limiting factors. Some operators, of course, substitute a single, very long Yagi for a box of four shorter Yagis.

In the cases of K5GW, W5UN, and others fortunate enough to have 48 to 64 Yagis in their arrays, this process continues beyond 16 Yagis to 32, then to 64 Yagis, thereby creating such a narrow beamwidth that the crater-rim-reflection mode is excited. Other amateurs with wider beamwidths cannot confine their signal beams within a crater rim, and too much signal power is lost. But the very narrow beamwidth from the largest arrays, fitting inside the crater rim, comes to the rescue just when it's needed most—around New Moon. Note also that, if 128 or 256 Yagis are built into an array, even smaller craters may be utilized.

Figure 2 shows a simplified diagram of how such a switching system works. As one might imagine, a significant investment in high-quality coaxial relays is required to make such a system work. These world-class EME operators truly are dedicated to perfecting their art!

The formula which proves this relationship is a summation of the effects described above. It is:

$$A = \{P[\pi R^2 - 4I] / 4\pi F\} \cdot [10 \log (O_1 + O_2)] \cdot [L_1/L_2]$$

where

A = Available Signal
P = Percentage of Moon Surface Available
R = Radius of the Crater Rim
I = Inferred Surface Error
L_1 = Path Loss at Moon Perigee
F = Tacheyon Shape Factor of Crater Rim Wall
O_1 = Overall Gain of Individual Antenna Blocks
O_2 = Overall Gain Factor (in dB) of Antenna Block Addition
L_2 = Path Loss at Moon Apogee

Therefore, at Full Moon, the Available Signal (A) from a 1-kW station running 64 10-element Yagis is ≅8.5 dB, while at New Moon the Available Signal is slightly less, ≅6.3 dB, an excellent fit to observed signal differences of about 2 dB.

Summary

This article has sought to describe and quantify the physical forces affecting EME communication during the moon's orbit of our Earth. The results of my investigation track well with real-world observational measurements, and I therefore have great faith that any modeling or computational approximations are of negligible significance. It is hoped that this dissertation has contributed a new body of knowledge regarding the mysteries of EME communication. ■

Notes:
1. Dr. Shimbun is currently on sabbatical in the Isles of Langerhans; his last known e-mail address was <Tshimbun@mangetsu.edu.jp>.
2. Also known as "Highland QSB."

Two-Wheel Public Service—Plus the Northeast Ice Storm

This month, we take a look at several cycling events that use ham radio operators to provide vital communications along the route—some that have combined ham radio and cycling—and other innovative uses of this unique combination of the two hobbies.

Each year, hundreds, if not thousands, of cycling events take place across the country. Some cover a relatively short distance. Other events cover several hundred miles, last for a week or longer, and involve thousands of participants. Here's a look at a few of them and at how ham radio fits in.

The "Tour de Cure"

Colorado's *Tour de Cure* offers some insight into the planning and work required to make this annual diabetes fundraiser not only a communications success, but a successful cycling event. The tour covers three separate routes, ranging from 25 to 100 kilometers. The terrain ranges from flat level roads to mountain canyons and peaks reaching 9,000 feet into the sky. And, of course, amateur radio plays a role.

John Einberger, NØMSA, says Denver area hams recently met the communications challenge the tour presents by first conducting a radio survey of the planned routes to determine which of the available 2-meter repeaters would offer maximum coverage with minimum dead spots. Two repeaters were chosen; one for the mountain area and the other for the flat terrain.

Thirty-two operators were required for the three routes, covering eight rest stops, eight checkpoints, five SAG (support) wagons, four emergency vehicles, and three net control (NCS) positions. Last year, they added five bicycle-mobile operators, who rode behind the last rider to make sure all riders either finished the tour or were picked up.

David Perry, NØIBT, bicycle-mobile, working communications on the "Tour de Cure" bike-a-thon. (Photo by Hartley Alley, NAØA)

Prior to the event, a communications schedule was drawn up detailing each ham's assigned location, start time, and expected completion time. In addition, a comprehensive operating procedure was distributed along with a list of DOs and DON'Ts. The Net Controls had a list of local hospitals, ambulance services, and police departments for each city the routes traveled through, along with each county sheriff. Each NCS also had a cellphone available to directly contact any of these emergency agencies.

Biking Back East

Back on the east coast, Bucks County, Pennsylvania, ARES (Amateur Radio Emergency Service) was instrumental in helping out at the 1997 Philadelphia Collegiate Challenge. University of Pennsylvania cycling coach, Peter Durdaller commented that the hams "made the logistics of course control and safety oversight so much easier and secure."

Durdaller explained that

"...course control and the ability to know where the participants are on the course is such a large part of any cycling event. Even more-so when it is a competition and the participants are exerting themselves close to their physical limits as fatigue and misjudgment can make a small mistake become one which imperils both the athlete who makes a mistake as well as those around him or her. Having constant communications around a course is therefore invaluable."

Durdaller continued,

"Additionally, ARES Emergency Coordinator Thom 'Buff' Butfiloski, KF2PM, and

By Bob Josuweit, WA3PZO (bjosuweit@aol.com)

his folks knew exactly what was needed. They were able to determine where they needed to be for the best course coverage. Decisions regarding placement of operators were never left to people as myself; much as I understand racing (30 years as a rider and the last five as a coach and promoter), I am not familiar with the capabilities of their equipment to be able to make competent decisions."

Durdaller concluded his remarks with, "They were great and I can not imagine ever again promoting a road race without such assistance." Plans are already in place for this month's East Coast Collegiate Cycling event in the Philadelphia area. And ham radio will most definately be a part of it.

The "Hilly 100"

Ken Ratcliff, KB9MQT, of Bloomington, Indiana, and his 14-year-old son, Kevin, KB9MQU, obtained their ham radio licenses specifically to stay in contact while riding, an activity the family has been doing for years. During the annual "Hilly Hundred Bicycling Weekend" in Bloomington, they acted as bicycle-mobile roving SAGs. They reported mechanical breakdowns, helped find misplaced children, and got answers to questions from fellow riders.

The Hilly Hundred has used a combination of amateur radio operators using voice and packet, and Civil Air Patrol members flying overhead and reporting potential problems to their net controls on the ground. The ham radio net control was set up next to the CAP station. On occasion there was interference between the two services, but Communications Director Barbara Anderson, N9XSS, reported that the problems were worked out. A GPS (Global Positioning System) packet reporting system (APRS) was installed in two of the SAG vehicles to help the command post keep track of their locations. The two (non-ham) drivers were *not* happy to learn that HQ knew when they were not on the route or even close to it!

Ohio Bound...

One of the largest cycling events to exclusively use ham radio for communications is the *Great Ohio Bicycle Adventure* (GOBA). This is a one-week scenic tour of rural Ohio. Each June, 117 hams provide communications for what amounts to a moving city of 3,000 cyclists traveling 50 miles down the road each day.

Hams Respond as Ice Storm Wreaks Havoc on New York, New England, and Canada

On January 7th, 1998, northern New York, New England, and sections of Canada were struck with severe icing conditions, knocking down trees, power and telephone lines and making communications and travel next to impossible. In some areas power was not restored for over a week. At press time, word was just coming in as to the large amount of support amateur radio operators provided to the storm ravaged area.

Amateurs were activated to support local, county, and state government, the American Red Cross, the National Disaster Medical System, and other agencies. In New Hampshire, official situation updates said they were working on the distribution of and coordination of ARES operators, communications, equipment, and manpower.

The broadcast program, "This Week in Amateur Radio" (TWIAR), reported that New York State RACES was activated and established HF operations 7255 and 3993.5 kHz. On VHF, the 145.39-MHz repeater on Mt. Equinox, Vermont, was used to link the capital in Albany with upstate areas. In addition, the State Emergency Management Office and the National Weather Service at Albany monitored river watch operations along the Mohawk River in Schenectady, Fulton, Montgomery, and Schoharie Counties on the 147.06 repeater in Schenectady, New York.

The ARRL reported that in Northern New York, a "voluntary communications emergency" was declared by the Federal Communications Commission. The FCC requested all amateurs "to cooperate by recognizing the existence of a voluntary communications emergency and therefore relinquishing the use of frequencies between 145.100 MHz to 145.120 MHz, 147.140 MHz to 147.160 MHz and 147.275 MHz to 147.295 MHz (for) handling of emergency traffic only." This essentially provided "clear channels" for emergency communications on area repeaters operating on 145.110, 147.150, and 146.285 MHz.

"Sid" Caesar Helps, Too!

Steve "Sid" Caesar, NH7C, serves with an Ohio unit of the National Disaster Medical System which was deployed to the affected area in New York. He has been working as a communications specialist for the Management Services Unit (MSU) division of the Office of Emergency Preparedness, Department of

Typical ice storm damage in the Watertown, New York, area. Note the downed tree limbs and power lines. (Photo by Sue Edmonds, N2GNN, courtesy ARRL)

Ham and Civil Air Patrol member Jim Edmonds, WA1KPG, works with the Red Cross doing "route reconnaissance" in the Watertown, New York, area. Jim came in to help from Liverpool, New York, near Syracuse. (N2GNN photo, courtesy ARRL)

Health and Human Services, supporting the Disaster Medical Teams (DMAT) in Lake Placid and other Northern New York towns. Steve arrived on January 12 and was stationed in Albany, some three and a half hours south of the Olympic Village in Lake Placid. He provided the following report:

The Commo Team is comprised of three members, Sparky Spradlin, KE4QGF, Mark Swicord, KD4EYF, and Steve "Sid" Caesar, NH7C. The team has been busy with many different projects. Equipment requests and dispersal activity has leveled out, while computer/network support has now taken center stage. Equipment purchases have been planned to improve the computer support to the MSU staff. Some of our many activities include: Re-programming and distribution of cell phones to liaisons, drivers and staff; Testing & installation of the UHF MSU repeater; and ham radio contacts for HF, VHF, & UHF traffic.

The ham radio operators in the local area have been extremely helpful with providing local information about public service and ham radio resources. Tony, WB2BEJ (the ARRL Eastern New York Section Emergency Coordinator), has been working with us since the beginning. Traffic has been passed via the local ham traffic network (both VHF and HF) to some of our outlying sites. The frequencies that have been reported in use for traffic include 3.993.5 MHz and the 147.120 MHz repeater. Many repeaters in our area of concern are not functional due to lack of power or damage from the ice. (*"This Week in Amateur Radio" reported, however, that despite reports to the contrary, many amateur repeaters did manage to stay on the air, even under "the most extreme icing conditions." —ed.*)

"The power is out and will be out for a long time in the northern counties," Caesar concluded, "We have had reports of people that have died due to carbon monoxide poisoning. These folks do not want to go to the shelters due to the threat of looter and crime. Without heat, these people use any means possible to keep their family warm. Unfortunately, there have been problems.

The Best and the Worst

Charlie Bliss, KB2UII, of the Weather, Emergency & Services Teams, reported that the pictures on the news didn't begin to show the true amount of damage.

On New York State Route 11, you can drive for miles at a time and not see any electric poles standing. All of them were either broken off halfway up or completely down. Several groves of pine trees that were 60–80 feet high had all of the branches stripped and there was just a pile of pine branches on the ground.

The storm brought out the best and worst in people. One man was on his roof chopping ice. He had a generator running in his front yard powering his house. Two men in a pickup stopped, unplugged the generator and tossed it into the back of their pickup and took off. The telephone company had several portable generators powering their small switching stations and somebody stole them, leaving thousands of customers without phone service.

Two other amateurs serving in the public interest at DMAT locations in New York are Bill Dunn, N1KUG, and Ron Headly, WD8QAZ. Both were deployed with DMAT units to hospitals and nursing units in the Plattsburgh and Malone, New York, areas.

Sleep has been short to non-existent for many amateurs in the area. We hope to have more coverage in future issues. If you have a story to share, send it to bjosuweit@aol.com or CQVHF@aol.com.

Net Control Thom "Buff" Butfiloski, KF2PM, coordinates operations for the Philadelphia Collegiate Challenge bicycle race. (Photo by Barry Burton, N3VOW)

GOBA Communications Director Bill Sharp, W8HI, says net control responsibilities are handled by different amateur clubs each day. Volunteers often leapfrog from one location to the next to provide the best possible coverage between towns. Sharp reports that amateurs handle communications for three medical vehicles and the SAG vehicles; and are assigned to fixed locations, such as hospitals, along the route. Other bicycle-mobile hams are assigned to different locations within the cluster of riders. (*See next month's issue for Bill's article on how GOBA hams wire their bikes for amateur radio.—ed.*)

GOBA has tried using cellular phones for the past several years. But Sharp points out that, while cellular provides good point-to-point communications, the broadcast feature of amateur radio outweighs the occasional benefits of cellular, such as the occasional a need for privacy or to talk to a local store about "commercial things."

Watching over the pack is important, but knowing if there are any stragglers can avoid having a missing person. (Photo by Barry Burton, N3VOW)

Another item which has helped GOBA organizers is the use of pagers to get weather updates. This has proved invaluable as they have been surprised by a tornado in the past. Working with NOAA forecasters, riders were moved out of the storm's way and under cover.

Just how busy are the hams during the GOBA event? There was an average of one medical call an hour and four hospitals runs each day. "Because of our ham volunteers, in particular the bicycle mobile hams," Sharp says, "the response time continues to be right at six minutes. Said another way, when asked for, help was on the scene quicker than if 911 had been called."

Bike-Mobile: Not Only for Cycling Events

West coast amateurs have found bike-mobile operators to be of use during non-cycling events as well. A recent MS (multiple sclerosis) walk-a-thon gave Oakland, California, ARES/RACES members a chance to operate bicycle-mobile. Three operators were able to work simplex at all times from Crown Beach to Bay Farm Island, California. There were several occasions when these stations had to relay messages for other operators, and they were able to provide communications from points on the route that were not accessible by car.

Still other cycling hams in California are looking at the need for bike-mobile operators during disasters. Some point out that if there is an earthquake, roads and highways will become impassable for cars. However, ham operators on bikes will likely be able to get around most of the damage.

The BMHA Connection

One organization that promotes the merging of ham radio and bicycling is the Bicycle Mobile Hams of America (BMHA). Formed in 1989, BMHA has over 450 members from 46 states and six countries. Founder Hartley Alley, NAØA, says most BMHA members have ridden the "Century," an annual tradition in cycling in which thousands of cyclists ride 100 miles in a day. BMHA has been in contact with tour groups around the country promoting the use amateur radio for cycling events. You may want to

Some Common Biking Terms...

Break—A small group of riders that pull away from and lead the pack (larger group) or riders.

Broom Wagon—Vehicle that marks the end of event rider support. All riders should be ahead of the Broom Wagon.

GORP (Good Old Raisins and Peanuts)—Rider food.

Road Rash—A skin abrasion suffered during a fall from a bike.

SAG—A support vehicle or person. Sometimes called a *SAG WAGON*, a vehicle assigned to transportation of sagged (tired or injured) riders to a rest area, event HQ, or the finish area of the day's ride.

Sweep—To patrol the course after the last rider is presumed to have passed.

—Courtesy BMHA

"On New York State Route 11, you can drive for miles at a time and not see any electric poles standing....Several groves of pine trees that were 60–80 feet high had all of the branches stripped and there was just a pile of pine branches on the ground."

—Charlie Bliss, KB2UII

check out the group's Web site at: <http://www.ragbrai.org/bmha/bmha.html> or see the BMHA folks at the Dayton Hamvention™ in May.

BMHA member Dave Gerbig, WB9MZL, has written two booklets which can be useful for the ham helping out for the first time on cycling events, or to introduce ham radio to cycle tour leaders (see "Resources"). First and foremost, Gerbig says, when hams help on a cycling event, they're expected to provide emergency communications. Even experienced riders sometimes crash. The injuries will not always be a matter of life-or-death. The rider may be more concerned over the condition of his bike rather than the scrapes and bruises. However, serious injuries can happen and operators must be ready to respond.

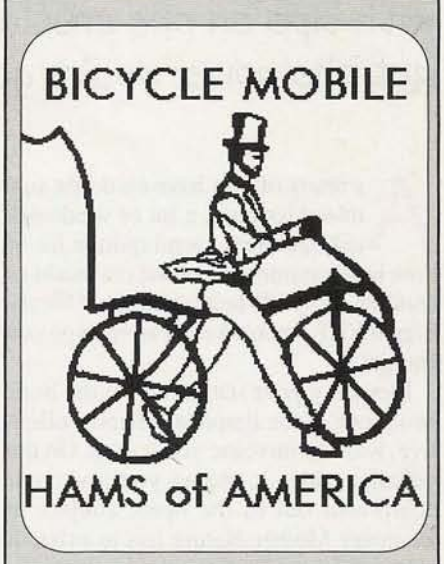
Other communication involves administrative and logistical support. The lack of water on a hot day or during a long event can affect many riders. Gerbig reminds hams that we are communicators. So *communicate*! There are also problems with lost riders. Families and friends get separated. Generally this resolves itself, but it may take an hour or two without our help. Finally, on overnight rides, there are great opportunities for public relations and ham recruitment at rest stops.

Combining Hobbies... In the Public Interest

This month, we've taken a look at hams combining hobbies to serve in the public interest. Having worked with BMHA Chairman NAØA and staff for the past year, I can really tell that these guys have fun on the road. If you're interested in cycling and hamming together, check out BMHA. They'll be happy to help. ■

Resources

For further information on BMHA and a sample newsletter, readers can write to BMHA, P.O. Box 4009-CQ, Boulder, CO 80306-4009. The two booklets, *Radio Operator's Guidebook* and *Tour Leader's Guidebook*, are available for $2.00 each, postpaid at the same address.



FCC Callsign Update

The following is a list of FCC sequentially assigned callsigns (*not* including vanity calls) issued as of February 2, 1998 (Courtesy FCC/ARRL):

District	Group A Extra	Group B Advanced	Group C Tech/Gen	Group D Novice
0	ABØHF	KIØLO	++	KCØCRE
1	AA1TE	KE1JE	++	KB1CIT
2	AB2EX	KG2NO	++	KC2CYG
3	AA3QT	KF3AW	++	KB3CBT
4	AF4HV	KU4OF	++	KF4VRS
5	AC5OX	KM5OU	++	KD5DFM
6	AD6EJ	KQ6UM	++	KF6PIL
7	AB7XF	KK7LT	++	KD7AKT
8	AB8BV	KI8FA	++	KC8JFJ
9	AA9VK	KG9MI	++	KB9SAO
N. Mariana Is	NHØB	AHØAY	KHØGV	WHØABI
Guam	++	AH2DF	KH2TA	WH2ANV
Hawaii	NH7F	AH6PF	KH7IN	WH6DEN
American Samoa	AH8P	AH8AH	KH8DL	WH8ABF
Alaska	ALØH	AL7QY	KLØLN	WL7CUQ
Virgin Islands	++	KP2CM	NP2JX	WP2AIJ
Puerto Rico	NP3S	KP3BE	NP3TS	WP4NNP

++All callsigns in this group have been issued in this district.

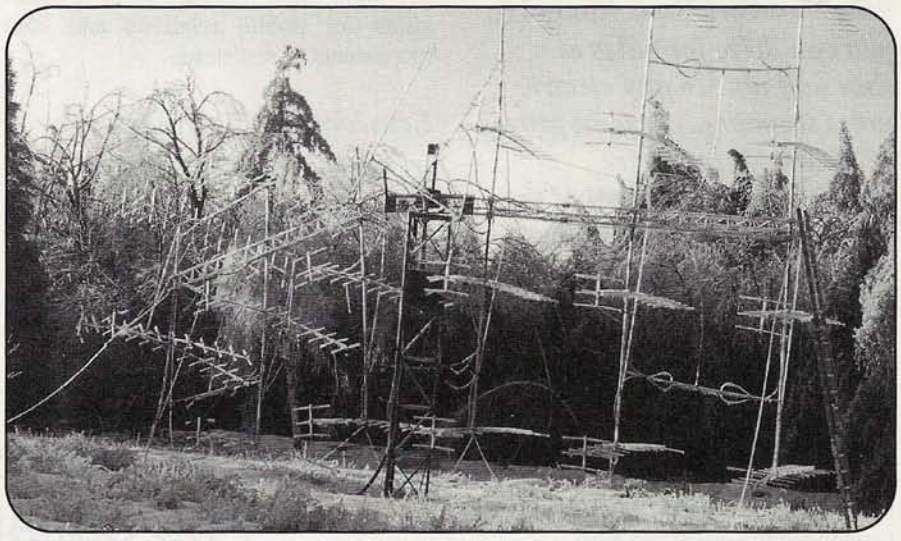
The "Power" of Portable Operating

In honor of our Mobile Special this month, Tim takes us on the road with tips on one crucial aspect of VHF portable operation. How do you get the power you're going to need?

As many of you have no doubt surmised by now, a lot of weak-signal operators spend quite a bit of time in the summer atop one mountain or another. Why? When operating "Weak-Signal VHF," you take any advantage you can get.

Elevating your station above the horizon is one of the simplest, yet most effective, ways to increase your range. On the negative side, it places you and your equipment out in the open, subject to whatever Mother Nature has to offer. It also removes you from the commercial power grid (and all that power line noise!), leaving you looking for something to plug that kilowatt (kW) amp into. Every active mountaintopping operator has developed his or her own unique solution to dealing with this dilemma.

Some of the most obvious are to use a generator, deep-cycle batteries, solar chargers, wind-powered chargers, the car battery, or, if you're QRP (low power), to use dry cells and call it good. The solution you choose will depend upon the power requirements of the station you plan to assemble. Obviously, a kW transmitter won't run long off battery power, but that same power source might keep a 100-watt transmitter on the air for most of a weekend. Let's look at the pros and cons of your two main options, generators and batteries.



Disaster area. If you're wondering why you haven't heard K1WHS on moonbounce in the past couple of months, here's your answer. The January ice storm that shut down northern New England, northern New York, and parts of Quebec and Ontario also wiped out Dave's "Maine Monster" 2-meter EME array. (Photos by K1WHS, courtesy K1WHS/ARRL)

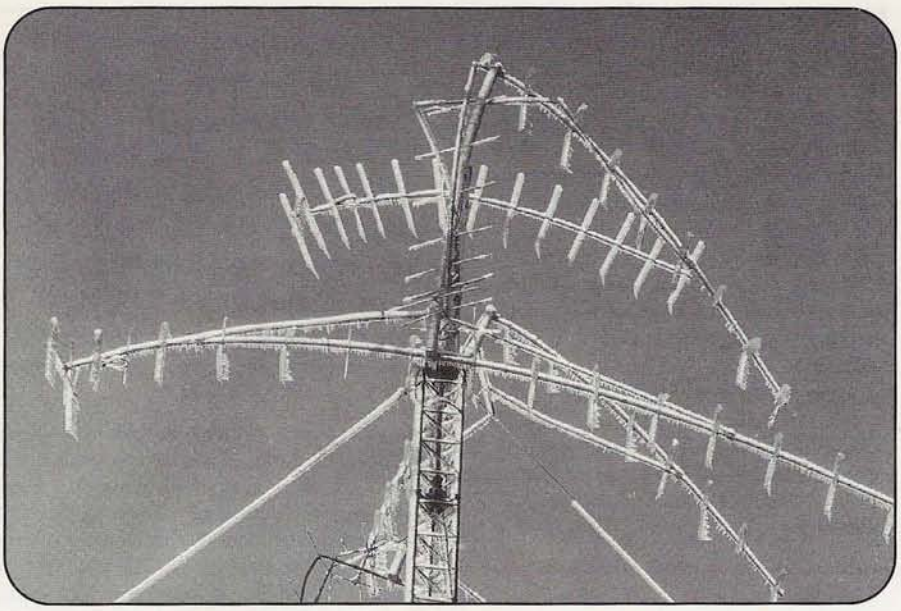
Generators

Generators are the only way to go if you're in the high-power set, unless you're lucky enough to have access to commercial mains on your mountaintop—a rare situation at best. Pond Peak, here in DM09, was my site of choice for many years. One reason was the 220-volt, 30-amp service, along with a 10-kW backup generator, already on site. Unfortunately, the inevitable growth that quality sites go through has forced me to abandon it as a viable location.

Nowadays, our multi-op group (Dave, W7KK, and I) activates rare grids in the middle of nowhere. This required us to invest in a few large generators. Several caveats should be kept in mind when choosing a power plant: 1) Make sure it's large enough for your needs without being too big to handle by yourself. 2) Double- and triple-check its operation *before* carting it off to some remote site and finding out it needed to be serviced. 3) Change its oil at the beginning of every contest season; it's cheap insurance against the unthinkable. 4) Spend the money and invest in quality AC extension cords capable of handling the current draw. It makes no sense to go to all this effort and waste the power needed to run the station by using lossy cables.

Once you've done all that and you're ready to set up on the site, keep these tips in mind: 1) Clear the area around each generator of flammable debris for 10 yards in all directions and keep all fuel containers well away and upwind. I keep a shovel nearby, along with a fire extinguisher, just in case. 2) Pay close attention to how the transmitter loads down the generator, and, if necessary, adjust your output power to a more suitable level. Using good common sense will go a long way toward keeping you and your equipment healthy for a long time to come.

By Tim Marek, K7XC (K7XC@VHF.RENO.NV.US)



Closeup view of what ice can do to aluminum. This used to be a quad array of four 2-meter Yagis, 100 feet up on one of K1WHS's towers in Maine. As Dave commented after the storm, "I've got a lot of work to do."

Our multi-op group now has three generators at our disposal: a 650-watt Honda, a 3500-watt Generac, and a 5000-watt Generac. Each has its advantages and disadvantages. The 650-watt model will power the average 100-watt single-op station, and then some, using only four gallons of fuel over the average contest weekend. It's light, quiet, reliable, and always in my truck.

To deliver the amps required by our power hungry Triode kW amps, we use the Generacs along with large AC power cords. These require more gasoline/manpower to set up, use, and maintain, but the results are worth it! In 1996, we were atop Booker Mountain in DM18, an extremely rare grid, running large antenna arrays and kW power on 50 and 144 MHz. Six meters was so-so on Saturday, with plenty of rocks (meteors), but very little *Es* (sporadic-*E*). Sunday morning came along and the band exploded with some of the best *Es* conditions I've ever heard. We were in the right place at the right time with the right equipment to take advantage of it. The double hop opening into W4 land was incredible, lasting 9 1/2 hours. For 37 minutes, we even had a 2-meter *Es* opening into the Midwest! Dave worked five states and 15 grids, ranging from EN00 to EN50.

What does this have to do with running a generator? Had we been at the 100-watt level, we would have worked much less than we did. Having a "big stick" attracts a lot of attention and makes working under less than desirable conditions that much easier. All that was possible because we had invested in the proper gear to support the kW amps. You've gotta use power to make power!

Batteries

Battery power works well at the 100-watt power level, especially if you're charging the batteries with solar cells during the daylight hours. A typical RV deep-cycle battery in good condition will usually last a whole weekend. There are better batteries available but they're huge and hard to maneuver. Larry, K6AAW, has used RV batteries for years on portable operations with good results. The complete lack of generator noise is a huge plus for some folks.

As a Rover, I use nothing but battery/alternator power during a contest, with the engine running almost 24 hours a day. I finished the 1994 January VHF Sweepstakes contest on top of Peavine Mountain here in DM09. The battery had been weak before I left and, with all the activity over the weekend, an hour of steady use was the straw that broke the camel's back. It was so flat that the engine wouldn't run. Here I was, 8:00 p.m. Sunday, atop a snow-covered 8,000-foot mountain, in a dead vehicle. It was very windy, with peak gusts over 70 mph—and it was beginning to snow.

"Battery power works well at the 100-watt power level, especially if you're charging the batteries with solar cells during the daylight hours. A typical RV deep-cycle battery in good condition will usually last a whole weekend."

The 650-watt Honda was in the back, along with a battery charger, just in case I did something this dumb. Only one problem: it was too windy to open the hood. So I did the only thing I could; Under the light of a full moon, I coasted two miles down the mountain to a sheltered area where I could raise the hood, fire up the generator, and charge up the truck. Note: *Always, always turn the truck around and point it downhill before turning it off and operating*. Had I not done this I would probably still be there! Currently, I have the biggest battery I could find under the hood and I buy a new one every two years. I still carry the generator and battery charger...just in case.

One other thing I did was to use two- or four-pin Jones plugs on every piece of 12-volt gear and build a power distribution box covered with two- and four-pin sockets. This box plugs into a four-pin Jones plug that's on the end of the main line from the battery. Switching from battery power to a 12-volt supply running off the generator takes only a few seconds with everything set up this way. It's a bit of work to establish a standard, install all the plugs, build the distribution box, etc., but, in a contest where seconds count, it's well worth the effort to have a true plug-and-play system!

Activity Reports

Here are some more reports from the fabulous New Year's openings on 6 and 2 meters. (I had a computer crash and lost the activity reports from the rest of January. Sorry.)

From Oscar, CO2OJ EL83:

12/31/97—In Cuba, 1997 ended with a good 6-m double hop opening last from 2145 UTC on. Before that time, heard some stations in Virginia and worked W9BN, EM34, and KB8TEJ, EM79. With the antenna beaming to the north, W6XI answered my CQs, and when I heard his DM42 and turned my beam to the west, the party started.

Worked 20 stations from 2200 to 2230 UTC in New Mexico, Arizona, and California from DMs 04, 12, 13, 14, 33, 41, 42, 43, and 51. Also two stations in Texas: EL09 and EL29. Most of the signals were S7-S9. Before I left the band at 2230, heard XE2??? with a big W6 and W7 pileup on 50.119 MHz. Who says 6-m is not a magic band?

From Jordan, WB2QLP EL96:

1/1/98—6-m DX! WOW! What a way to start the New Year...I worked PY5CC GG54, PY2XB GG66 & HKØHEU EK92 on 6 m (50.110–50.101). Nice start to 1998.. I think Cycle 23 has a lot of DX in store for us.

From Jay KØGU DN70mq:

1/1/98—Nice 2-m *Es* opening here tonight. A little slow in the beginning. Guess most everyone was watching the Rose Bowl. I was watching it on channel 3 in Corpus Christi (I think). At 2355 Z I began working WA5ASW EL29, 0013 K5IUA EL29, 0014 KB5ZIV EL29, 0048 KB5RIN/M EL09, 0052 KM5RG EL09, 0052 N5WS EL09, 0052 W5VY EL09, 0053 N5ZZ EL09, 0053 KI5GF EL09, 0057 WA5IYX EL09, 0057 W3XO/5 EM00, 0057 N5BBO EL09 & 0101 K5WN EL09. I Worked KD5AIG DM80 on 6 m. A rare grid from here. Also caught XE2/KC5FMT/M in EL05 on 6 m.

From Jim, KD5BUR EM23wk:

1/2/98—In a 2-meter FAI opening to the west @ 0200 Z, I worked N7WS DM42, AA7A DM43 & W7RV DM43. All watery CW contacts.

From Cap, W6CAP DM14:

1/2/98—After reading the post from KD5BUR on the FAI, I rushed over to my rig, and tuned to 144.200. Gave a cuppla calls on CW, two stations came back to me. One was quite slow CW, approx 7 wpm. The other moderate speed, around 15 wpm. I couldn't get the calls. Tried again, the station with the slow CW came back. Still couldn't get the calls. Signals were very watery. Called CQ many more times but by that time they were gone. The time was 0330 Z. The stations that called, I would like to know who you were, Please e-mail me. Seems that as 6 meters starts to die out, it is the best time to start looking for FAI on 2 (*That seems to be the way it usually works.—ed.*). It would probably help if one were to make a sked with another station in the suspected area at the time the band starts to fade.

"[When I] turned my beam to the west, the party started. Worked 20 stations from 2200 to 2230 UTC in New Mexico, Arizona, and California from DMs 04, 12, 13, 14, 33, 41, 42, 43, and 51. Also two stations in Texas: EL09 and EL29." — Oscar Morales, Jr., CO2OJ

From Wes, N7WS DM42jh

1/2/98—2-m FAI I began checking 2 m at 0140 Z after noting fairly strong interference with local channel 6 TV. I heard Ned, AA7A DM43 working many stations on 144.2, but I could not hear anything from the other end. Because of the apparent ease with which Ned was working, I assumed he was using *Es*. Tommy, W7RV DM43, also worked many of the same stations. At 0145, I tuned 144.205 and heard KK6IT EM11 calling CQ on CW with typical FAI quality. I worked him and returned to listening. At 0152, I worked K5YT EM22 & later I worked KD5BUR EM23. Other stations were heard on 144.2 but not worked because of QRM and/or SSB flutter. The amazing thing was that KK6IT was still heard calling CQ at 0230, on 144.205 with no takers. All stations were worked with beam heading offset from great circle path by about 25–30 degrees to the north.

That's All for Now

The *Es* session of Jan 1st provided some of the best conditions I've heard in over a year! A few weeks later, Ward, WB7VVD, and I finally did it...we *finally* broke the 20-grid barrier by activating 21 grids in the 1998 January VHF Sweepstakes! Whew!

Keep all the reports coming in. Thanks! Tim Marek, K7XC, 360 Prestige Ct., Reno NV 89506; Phone: (702) 972-4722; Fax: (702) 972-5011; e-mail: <K7XC@VHF.RENO.NV.US>.

73 from DM09bp de Tim K7XC/R

Reader FEEDBACK!

Dear *CQ VHF*:

Enjoyed reading your Feb., '98 issue of *CQ VHF*. In Gordon West's good article on GPS and the Maidenhead grids, I think there is a reversal of the sequence of how a UTM grid coordinate is put together...

On Page 49, column 1, he mentions that Northing comes before Easting. The U.S. Army and Air Force have published the definitive work (for us older survivors) regarding the how one manipulates UTM coordinates (TM 5-241 and TO 16-1-233) and they are quite specific about "reading right up"; that is, Easting from left to right followed by Northing reading up.

I dug up some more information that may be helpful, since the original printed manual is no longer available—I didn't even find it at the Library of Congress. There is a text file at <http://www.tufts.edu/~pstott/utm.txt> and what appears to be the current version including NATO conversions at <http://www.atsc-army.org/cgi-bin/atdl.dll/query/FM/34-85>, which are a series of downloadable Adobe Acrobat .PDF files.

The document is also available in straight HTML form in sections at the same site as <http://www.atsc-army.org/cgi-bin/atdl.dll/fm/34-85/toc.htm>, for those who like to go section by section and read from the screen.

73,

Art Martin, N2QAE
Long Valley, New Jersey
<amartin@interactive.net>

Art—Many thanks for the valuable information. As you've no doubt seen by now, we corrected ourselves several times over in the March issue. But the Web sites you dug up provide additional information sources—right from the horse's mouth, so to speak. Thanks again.

A Few "Facts" About Antennas

Here's more "myth-information" to start off our new antenna column: Everyone "knows" quads outperform Yagis, right? Or do they? WA5VJB has some answers from the antenna range.

With just a little persuasion—similar to the methods used by the Spanish Inquisition—Rich Moseson, W2VU, has talked me into writing an antenna column for *CQ VHF*, along with the microwave column that premiered last month. In addition to my microwave activities, I have quite a background in antennas. As you may have seen in last month's issue (pg. 72), I have been an umpire with the Central States VHF Society's Antenna Contest for over a decade. Also, for the last four years, I have been professionally designing specialized television antennas. And, as of last inventory, I have 37 antennas in the air at my QTH.

Last month, I started out my "Final Frontier" column with the "facts" everyone knew about microwaves. So this month, I want to discuss some "facts" that "everyone knows" about antennas. While there's a lot of "myth-information" out there on all sorts of antennas, I'm going to concentrate on the seemingly never-ending debate over the relative merits of quads and Yagis (if you're new to radio and you're not familiar with these terms, see "Aquadayagiwhat?" elsewhere in this article). Here are some so-called "facts" about quads:

- Quads have 2 dB more gain than Yagis;
- Quads have more capture area than Yagis;
- Quads are both vertically and horizontally polarized.

Quads Have 2 dB More Gain Than Yagis

Boy, this one is a quote of a quote of a quote going back some 40-plus years. I was able to dig up Moore's original study on quads versus Yagis[1] and, let me tell you, *it was not a level playing field!*

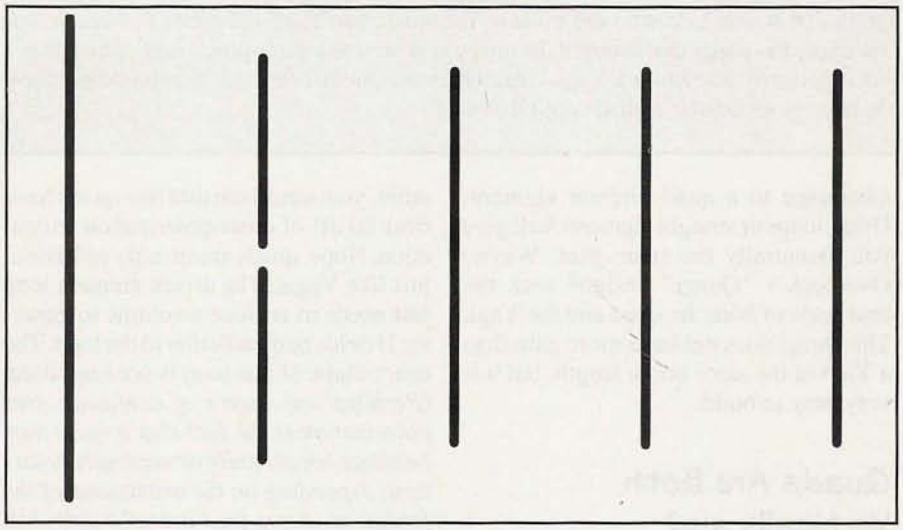


Figure 1. Non-optimized Yagi antenna.

Figure 1 shows you how early Yagis were built. All the directors were the same length. All elements had the same spacing. Easy enough, but in a modern Yagi, each element is smaller than the element behind it (actually, it's a progressively smaller *current* in each element that you want, and there are other ways of controlling element current).

So Moore was comparing his carefully tweaked and pruned quads to a slapped together, non-optimized, improperly scaled Yagi. As I said, it wasn't a level playing field. But more on modern quads versus modern Yagis in a bit.

Quads Have More Capture Area Than Yagis

Capture area is a function of gain, which, for both quads and Yagis, is a function of boom length. A two-element quad has about 1 dB more gain than a two-element Yagi. This varies a bit depending on whether the second element is a director or a reflector. But once we expand the antenna to three or more elements, gain is essentially the same. So, by definition, once we get beyond three elements, quads and Yagis also have the same capture area.

The advantage of the quad is in the loop driven element and reflector. These form a simple antenna with good impedance characteristics. However, there is no

"A two-element quad has about 1 dB more gain than a two-element Yagi....But once we expand the antenna to three or more elements, gain is essentially the same."

By Kent Britain, WA5VJB (<cqvhf@aol.com> — Attn: WA5VJB)

Aquadayagiwhat?

If you're new to antenna terminology, a quad is an antenna made up of two or more four-sided loops (generally, but not always, formed into a square or diamond shape). It was developed in the 1940s by Clarence J. Moore, W9LZX, who was the engineer at missionary shortwave station HCJB in Quito, Ecuador.

According to the story that's recounted in virtually every antenna book, the high altitude and thin air of Quito caused corona and arcing from the station's four-element Yagi antenna (we'll get to those next). Moore tried a variety of possible solutions before settling on what became known as the quad antenna design. The quad and variations on it have been popular among hams for decades, but not nearly as popular as the Yagi.

A Yagi is a flat "beam" antenna, and it's what most hams are referring to when they tell you they have "an 11-element beam" or whatever. It was invented in Japan in the 1920s by two university professors, Hidetsugu Yagi and Shintaro Uda. Actually, it was Uda who did most of the work, but Yagi's English was better, so he wrote the paper that brought the antenna design to international note. The antenna is properly known as a Yagi-Uda, which means that this sidebar should properly have been titled, "Aquadayagiudawhat?"

advantage to a quad director element. Using loops or straight elements will give you essentially the same gain. Wayne Overbeck's "Quagi" design[2] uses the best parts of both the quad and the Yagi. The Quagi does not have more gain than a Yagi of the same boom length, but it is very easy to build.

Quads Are Both Vertically and Horizontally Polarized

An interesting concept, but the polarization of the antenna is determined by the orientation of the E and H fields (electrical and magnetic, respectively) generated by the loop, *not* by the direction of the wire in the driven element. If this were so, you would see loop elements generate *every polarization*. Too bad it's mathematically impossible.

In Figure 2, we have a variety of quad or loop driven elements. All of these are horizontally polarized. And, if properly built and mounted cross polarized to each other, you would see that two quads have over 20 dB of cross-polarization attenuation. Nope, quads are linearly polarized, just like Yagis. The driven element loop just needs to enclose a volume to generate H fields perpendicular to the loop. The exact shape of that loop is not important. (*Perhaps one source of confusion over polarization is the fact that a quad may be* either *horizontally or vertically polarized, depending on the orientation of the feedpoint: if you feed it on the side, it'll be vertically polarized; a bottom feedpoint gives you horizontal polarization. But you still can't do both at once.—ed.*)

But Quads Cured My Gout!

Oh, I can see the letters now..."But I never worked Albania until I put up a quad," or "Quads cured my gout and arthritis." Quads certainly have a mystique, but this mystique cannot be duplicated on the antenna range. Each year, the Central States VHF Society holds a 144-MHz to 24-GHz antenna contest at its annual conference. For the last 11 years, Marc Thorson, WBØTEM, and I have been the range umpires. We bring the equipment, we set up the range, and we typically measure 100 to 120 antennas a year. Of the 1,000-plus antennas we have measured, only *once*, that is exactly *one time*, has a quad won. (It was a 42-foot-long monster 144-MHz quad, and it barely squeaked by an 18-foot-long Yagi). In side-by-side comparisons, quads have not stacked up to other antennas when measured with precision equipment under controlled conditions.

"...research has shown that SWRs have eight legs like other arachnids, but—and this is the important part—they don't necessarily put them all on the ground...at the same time."

EME (Earth-Moon-Earth) or Moonbounce is one of the most challenging activities an amateur can attempt: lots of power, state-of-the-art preamps, and extremely high-performance antennas are required. Beverley Cavender, W4ZD, publishes a directory of the more than 600 stations on 144-MHz moonbounce.[3] A scan of these stations showed that only two of these 600-plus EME stations are using quads; a scan of the 400-plus stations in the 432-MHz EME directory did not show *any* stations using quads. On Moonbounce, mystique just doesn't make QSOs. The antenna has to work and work well, and quads simply don't make the cut.

Here's a challenge to our readers: I have been unable to find a single commercial or military user of quads. Other than hams and HCJB on shortwave (for which the first quad antenna was invented; again, see "Aquadayagiwhat?"), does anyone know of a two-way, cellphone,

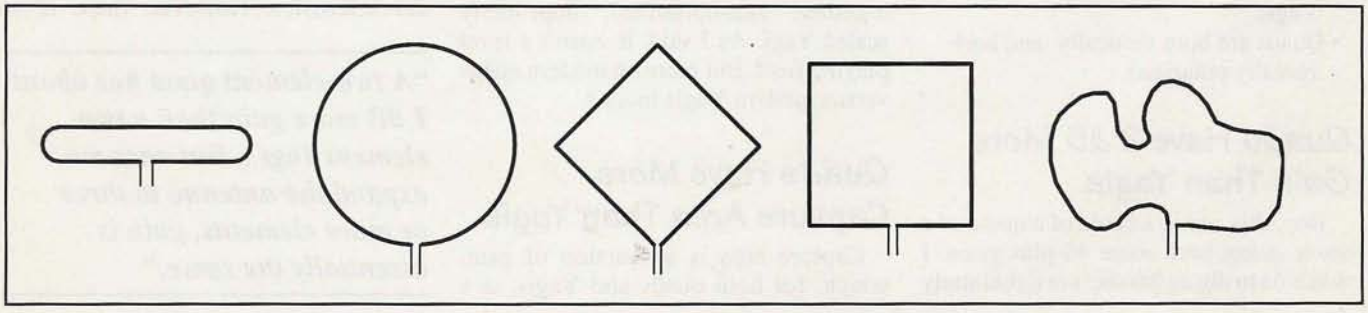


Figure 2. Examples of horizontally polarized driven elements.

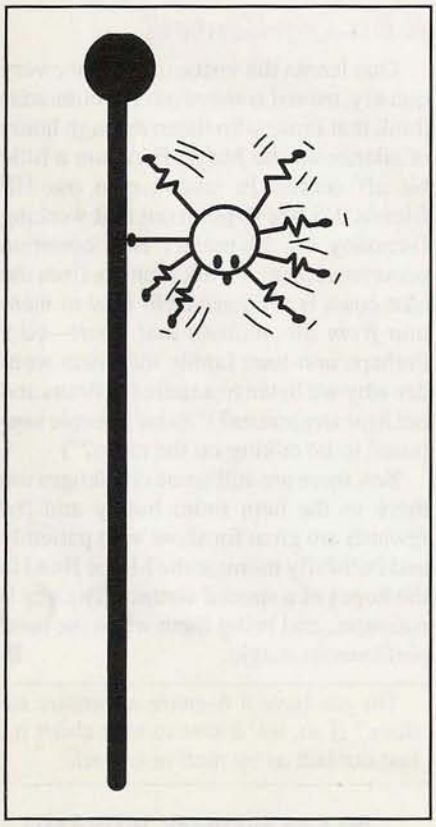
TV, satellite, or other industrial/commercial user or manufacturer of quad antennas? If quads are so wonderful, how come we don't see quad log periodics, quad TV antennas, quads on geostationary satellites, etc.?

OK, as you have guessed, I'm not particularly a fan of quads, although I currently have a patent pending on a television antenna using portions of quad elements. Over the coming months, we will be discussing how to properly design and build antennas of all types, including quads. But now, let's shift gears and discuss some important information on tuning antennas.

Care and Feeding of SWRs

As I am writing my first antenna column for the April issue of *CQ VHF*, I wanted to take this opportunity to discuss the very important question of *SWRs*. The SWR is a finicky little critter and an extremely difficult creature to study in its natural environment.

The most common question about SWRs is "How many legs do they have? Is it six legs like most bugs, or eight legs like spiders?" Well, research has shown that SWRs have eight legs like other arachnids, but—and this is the important part—they don't necessarily put them all on the ground (or on an antenna feedline) at the same time. As you get all those radio waves rushing up and down on an antenna feedline, the electricity burns the SWRs' little feet. Kind of like walking barefoot on hot asphalt in the summertime. They pick up one foot, then another and another. Your SWR reading goes from 8 to 4 to 2. Get the antenna really tuned sharply, and all those little SWRs lift up seven of their legs and stand on only one foot. Now the SWR count drops to 1 and all that signal is radiating off those other legs! Now your antenna will *really* get out!



But what if you've seen your SWR count higher than 8? Well, perhaps we'll talk about the mating habits of the SWR next April 1st.

73, Kent, WA5VJB

Notes:

1. The quad was developed in the 1940s by Clarence J. Moore, W9LZX, who was then the station engineer for shortwave broadcaster HCJB in Quito, Ecuador.
2. Overbeck, Wayne, "The VHF Quagi," *QST*, April, 1977, pp. 11–14.
3. Beverley Cavender, W4ZD, P.O. Box 88, Lake Placid, FL 33862.

Resources

For more information on Yagis, quads, and antennas in general, we recommend the following books:

The ARRL Antenna Book, ARRL, Newington, Connecticut, 17th edition, 1994 (previous editions OK, too). The ultimate authority on ham radio antennas, but may be too technical for beginners.

Lew McCoy on Antennas, by Lew McCoy, W1ICP, CQ Communications, Hicksville, New York, 1994. Everything the *ARRL Antenna Book* isn't—antenna basics in plain English, an ideal starter book for the newcomer.

Practical Antenna Handbook, by Joseph J. Carr, K4IPV, TAB Books, division of McGraw-Hill, Inc., Blue Ridge Summit, Pennsylvania, 2nd edition, 1994. In between the two books above, this has more technical detail than *McCoy*, and more easily understood explanations than *ARRL*.

The Quad Antenna, by Bob Haviland, W4MB, CQ Communications, Hicksville, New York, 1993. The only book we know of that's dedicated entirely to the quad.

Publisher Contact Information

ARRL, 225 Main St., Newington, CT 06111; Phone: (860) 594-0200; Internet: <http://www.arrl.org>.

CQ Communications, Inc., 76 N. Broadway, Hicksville, NY 11801; Phone: (516) 681-2922; Fax: (516) 681-2926; Internet: <http://members.aol.com/cqmagazine/>.

Tab Books, division of McGraw-Hill, Inc., New York, NY; Customer service: (800) 722-4726; Internet: <http://www.tabelectronics.com>.

Looking Ahead in *CQ VHF*

Here are some of the articles that we're working on for upcoming issues of *CQ VHF*:

- "The 2-Meter Loop Shootout," by Gordon West, WB6NOA
- "How to Wire a Bike for Ham Radio," by Bill Sharp, W8HI
- "100-Plus Miles on 2-Meter Mobile—Part 2," by Mark Casey, K1MAP
- "Mir's New Packet Station—The Inside Story," by Miles Mann, WF1F
- "Rover Operating—Scottish-Style," by Simon Lewis, GM4PLM

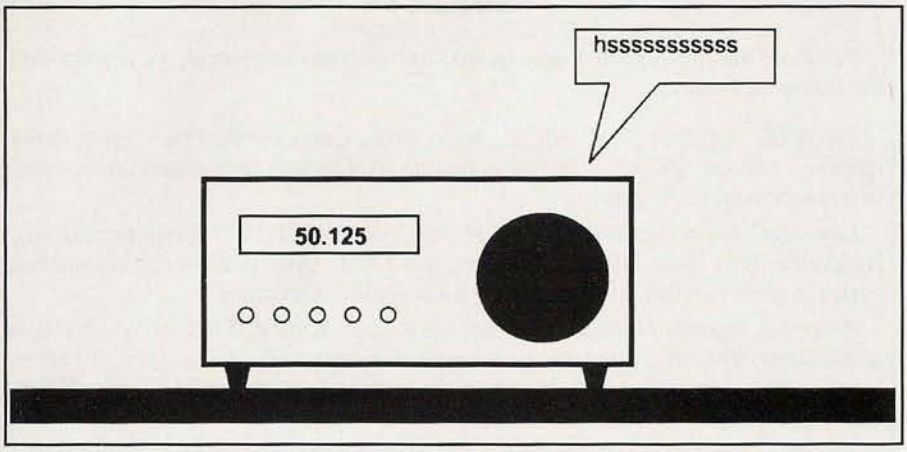
Plus...

- "Taking the Fear Out of Calling 911," by Neil Dabb, KC7GCL *and*
- A Trip Down Memory Lane...
  ..."The Golden Age of Kitbuilding Returns," by Sam Vigil, WA6NGH
  ..."Making a Swan 250 Work Like Almost New," by Dave Booth, KC6WFS
  ..."The Saturn-6 Six-Meter Loop Antenna," by Bill Pasternak, WA6ITF

If you'd like to write for *CQ VHF*, you may download our writers' guidelines from the *CQ VHF* World Wide Web site at <http://members.aol.com/ cqvhf/> or FTP to <ftp://members.aol.com/cqvhf/General> and look for the file, "writguid.txt." Or, you may send a written request with an SASE (self-addressed stamped envelope) to *CQ VHF* Writers' Guidelines, 76 N. Broadway, Hicksville, NY 11801.

The Silence of the Bands

Listening for signals on 6 meters, says WB2AMU, can sometimes be like Jodie Foster in the movie, "Contact," listening for signals from outer space...



"The Magic Band can be awfully quiet for very long stretches..."

There are certain times of the year when the weak signal portions of the VHF bands are quiet and devoid of even local chatter. A favorite phrase is that "without the rain, we cannot appreciate the sunshine." The same thing appears to be true for 6 meters. The Magic Band can be awfully quiet for very long stretches, and when we do get a good opening of some kind, we all get excited.

Seeking "Contact"

One of the best ways I can describe what it's like to listen to a quiet band for hours at a time is to point out the scene in the movie, "Contact," in which star Jodie Foster is sitting on the hood of her car for hours, listening to the radio for signals from outer space. A lot of us practice a similar ritual on the Magic Band. I find the background radio noise on 50.125 MHz to be soothing, and it helps me take a nap during my lunch break at work. Of course, if the band is open, I'll spring into action. Many operators keep the 6-meter radio turned on in the shack, tuned to the calling frequency, with the squelch up, while they go about their business in the shack. If the band should open, they'll be ready to make the most of it.

Strange Visitors from Other Planets

Sometimes a weak voice comes on via ground wave, or sometimes it's a quick burst in which just two words are heard; the latter is due to *meteor scatter*. Very rarely have I seen signals of this type develop into anything like a sporadic-*E* opening, but sometimes the meteor scatter can be strong for several minutes at a time, allowing stations to be worked. (*There are meteors entering the atmosphere all the time, not just during the major showers. Early morning is often the best time to catch a good "burn" and make a contact.—ed.)* But often, all that's heard is that one quick burst surrounded by hours of silence. It can be maddening to wait for propagation to develop on the Magic Band!

What are generally the quiet times on 6 meters? Typically, for most of us in the U.S. and Canada, there are two major quiet periods. This is generally from around February through late April and from mid-August through mid-October (basically a month on either side of the equinoxes). There may be an occasional sporadic-*E* or aurora opening or, during the sunspot peak, some F_2 skip; but, for the most part, it's pretty quiet. The lack of skip has an effect on local activity as fewer stations are inclined to listen during the quiet times. You sometimes have to rely on local beacons to assure yourself that the radio is still working! One goal of Magic Band operators is to keep the band going through these quiet times. There are a few nets throughout the country that help somewhat.

A Bit Off-Center?

One learns the virtue of patience very quickly, even if some of our HF comrades think that those who listen through hours of silence on the Magic Band are a little bit off center. In response to our HF friends, I'd like to point out that working Germany on 20 meters is a common occurrence, but to work it on six from the east coast is a bigger thrill (*not to mention from the midwest and west!—ed.*). Perhaps non-ham family members wonder why we listen to a radio for hours and not hear any voices? ("Aren't people supposed to be talking on the radio?")

Yes, there are still some challenges out there in the ham radio hobby and the rewards are great for those who patiently and faithfully monitor the Magic Band in the hopes of a special contact. The key is patience...and being there when the band performs its magic. ■

Do *you* have a 6-meter adventure to share? If so, we'd love to hear about it. Just contact us by mail or e-mail.

By Ken Neubeck, WB2AMU

Even though there were staggering costs, one has to remember that only *one* Atlantic hurricane, Danny, made landfall in 1997, resulting in a major disaster being declared for Alabama in July.

Minnesota and Washington State led the nation in the need for federal disaster aid in 1997, requiring four Presidential disaster declarations each to recover from the effects of severe winter storms and damaging spring and summer floods.

Are YOU Prepared?

So...are you prepared to meet the challenge? Is your ARES/RACES or public service group ready to respond when the power goes out? Are you prepared to fill the gap when the telephone network is not operational? Can you get across town when the road is blocked?

The first step in preparedness is knowing what to expect (beyond the unexpected) While the basics of disaster preparedness remain the same, each type of disaster can present its own set of circumstances. In 1997, flooding was the most common occurrence, figuring in 29 of the year's declared disasters. Severe winter storms were involved in eight declarations, hurricanes and typhoons in four, and tornadoes in three. While it's impossible to prepare for every eventuality, you should learn what types of storms are most common where you live, and learn what will likely be required of hams when "the real thing" hits.

So what do you need? It may be an antenna with greater gain than the rubber duck on your HT. It could be a larger antenna than the 19-inch whip on the car. An extra battery pack? Maybe your group could use a generator to power your club station or operate from a mass care shelter. How about some extra antennas and mast sections to raise your antenna so that height will overcome lack of power?

Many groups have formed mutual aid agreements with other public service minded hams in neighboring communities. This may be the next county or the next state. Having the agreement and plans in place can let amateur radio shine in the public interest. Here's where we can offer our skills as "trained communicators" with the ability to get messages through in a timely manner under the worst of circumstances. But remember to keep things flexible. We've all have heard of the "KISS" principle. You know, "Keep it Simple, Stupid." Remember it, and apply it.

Remember, too, that emergency preparedness is a *responsibility* of *every* ham. It is the cornerstone of our service—number one on the FCC's list of why ham radio exists: "Recognition and enhancement of the value of the amateur service to the public as a voluntary non-commercial communication service, *particularly with respect to providing emergency communications*." (Emphasis added). That's straight out of the FCC rules—Section 97.1(a)—the very beginning, even before the "definitions" section.

How Do I Get Started?

If you're not already involved with public service communications, you should first make contact with public-service minded hams in your own club. They can certainly can tell you what's happening locally. You may also want to contact your county ARRL Emergency Coordinator or the ARRL Section Emergency Coordinator or Section Manager (see the ARRL's Web site, <http://www.arrl.org>, or page 12 of any issue of *QST* magazine).

Next, participate in local public service events. Follow the reports of events in *CQ VHF* for ideas of how others handle similar events. When your event is over, send us a story about it.

If you're not familiar with disaster operations, take a course offered by the American Red Cross or the Federal Emergency Management Agency. The Red Cross course, "Introduction to Disaster," is a good start. Contact your local Red Cross chapter to find out when the course is being offered. FEMA has home study courses. These are open book "exams" and offer a good insight into the responsibilities of your local government emergency manager. Remember, the more you understand the workings of local emergency management agencies, the easier it will be to work with local government officials.

Finally, participate in your club nets. Here's a great way to learn net procedure and meet others on the net. If possible, practice passing traffic or formal messages. After all, you'll be expected to pass messages quickly and accurately. A big mistake can be made if a request for 10 cots turns into 100 cots. It's much easier to learn when mistakes don't matter!

"New Age" Disasters

TWIAR reported that Ottawa columnist Pierre Bourque, of *The Hill Times*, Canada's Parliamentary Newspaper, wrote in an extensive Internet posting on the Storm of '98 that Canada's Defense Department had called in 11,000 troops to help with the clean-up, that military helicopters were everywhere in the sky, and that the U.S. Air Force was sending up jumbo planes to help move material. Bourque's conclusion: "So much for the 'new age' with computers, cable, video, microwaves, etc. None of it works without electricity!"

So are *you* prepared to serve in the public interest? If not, are you prepared to learn?

—WA3PZO

In This Issue

This is our third annual Mobile Special, this time with a twist: several articles on mobile operating—without a car! If you own a bike and a portable ham rig, it could add a whole new perspective to both your cycling and your hamming! My thanks to Bob Josuweit, WA3PZO, not only for penning this month's editorial, but also for his help in arranging our bicycle mobile coverage.

And what about a boat? That's the next project for Steve Roberts, N4RVE, who's on our cover. Look for his article on the "Ship of Dreams."

Plus, Kent Britain, WA5VJB introduces his new column on antennas, which we've creatively dubbed, "Antennas, etc.," and Dave Ingram, K4TWJ, revives Don Stoner's "In Theory" column with a new title and a new focus—"How It Works" will take a look at all sorts of ham-related topics, dig around inside and show us all, well, "how it works." We hope you enjoy this issue, and all the ones to follow.

—W2VU

Help Wanted

If you're involved with a project or activity that you think would be of interest to your fellow *CQ VHF* readers, we'd like to hear from you. Article submissions are welcome, as are "Op-Ed" opinion pieces if you have a point of view you'd like to share about a VHF-related topic. You can contact us by mail at 76 N. Broadway, Hicksville, NY 11801 (send an SASE for writers' guidelines), by e-mail to <CQVHF@aol.com>, or via our World Wide Web page, <http://members.aol.com/cqvhf/>. We look forward to hearing from you.

Demystifying Capacitors, Coils, and Antenna Tuners—Part 1

In a blend of old and new, K4TWJ takes over where W6TNS's "In Theory" column left off last October, but with a new title and a somewhat broader focus. Where it goes from here is up to you!

A Few Words of Introduction...

I was elated when Rich Moseson told me that Dave Ingram had agreed to take over the "In Theory" column. I cannot think of a person more qualified than Dave to explain how things work and their relationship to ham radio.

I've known Dave Ingram for many years. When I edited a now-defunct ham radio publication, Dave was always there, on time, with material that was interesting to the readers. He received more fan mail from them than my editorials did!

Occasionally Dave used to send me items that were products of his bountiful brain. I will always value his rebel flag QSL that identifies my car in crowded parking lots. But most of all I treasure the little wooden roof with the thumbtacks under it. When I asked Dave what it was, he supplied the obvious answer, "A tax shelter."

Good luck, Dave, the column is in great hands. Looks like you are once again working for a great editor!

73 Don, W6TNS

I understand that Don Stoner will add some opening commentary to this new theory 'n practice column, but I'm unsure about what he will say. Hopefully, it won't be described as a direct continuation of Don's "In Theory" column, as I feel no one can replace Don, but only succeed him.

Don is an original and a classic, and his dedication to the hobby covers many decades. He helped usher transistors into amateur radio with his neat little "Semiconductor Space Spanner" during the 1950s (see Photo A); assisted in launch efforts for amateur radio's first satellite, OSCAR I, in the 1960s; and he was recognized by AMSAT with the

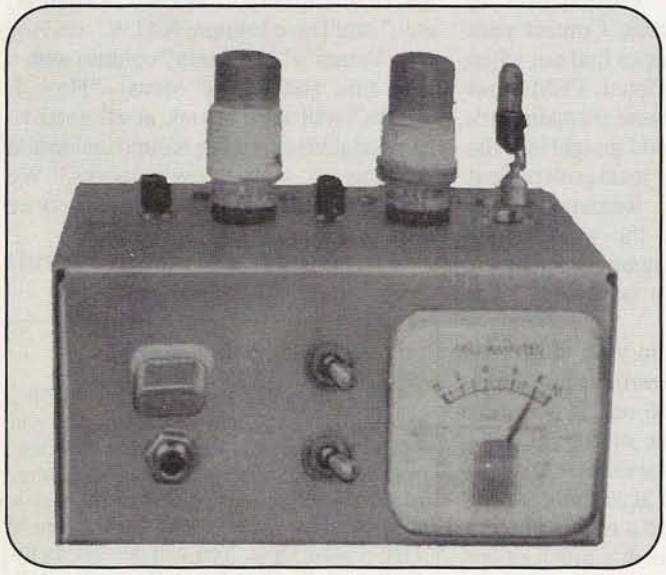


Photo A. Original (and authentically faded with age!) view of Don Stoner's famous Semiconductor Space Spanner transmitter of the 1950s. The little two-transistor delight introduced solid-state electronics to radio amateurs worldwide.

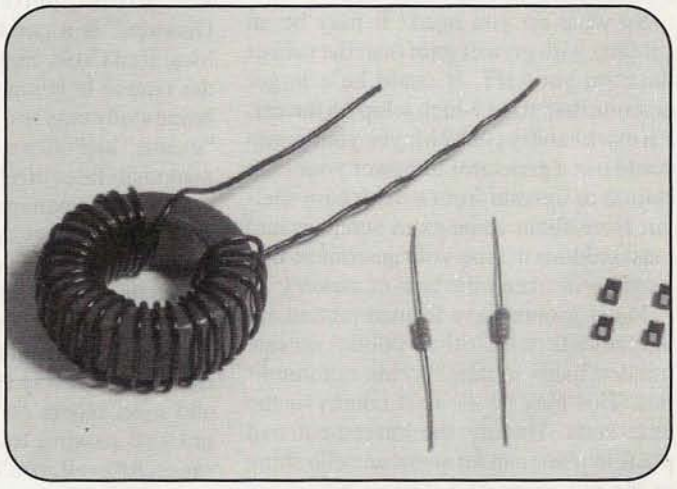


Photo B. Three popular types of "fixed" inductors: A toroidal core with "X number" of turns to yield a desired inductance, a prewound/molded inductor, and a "chip" inductor. Although quite different in size and shape, all three types can yield the same inductance. Chip inductors are often used in FM handhelds and compact transceivers using SMT, or Surface Mount Technology. (Photos B through E courtesy David Branch, KB5VKY, of MFJ Enterprises, Inc.)

By Dave Ingram, K4TWJ

Stoner Cup Challenge Award in the '80s. Don also founded the National Amateur Radio Association during the '90s, plus much more. It is indeed an honor to progress (with a few diversions!) along the general path Don pioneered here in *CQ VHF*.

How far off the path and how many diversions we'll pursue depend on requests from you, our readers. I'm maintaining high flexibility to match your input, so drop me a note on various topics or subjects you would like to see featured here. Meanwhile (and as a thought-inspiring example), let's continue on from Don's introduction of capacitors and inductors in his final column and discuss how those two components are used in popular amateur radio accessories: antenna tuners.

More Notes on Capacitors and Inductors

As Don explained in his October, 1997, "In Theory" column, two unique properties of capacitors are the ability to block DC while passing AC and the ability to work in conjunction with inductors to tune circuits. Looking more closely at this, we find the amount of AC a capacitor passes depends on its value, measured in microFarads (µF) or picoFarads (pF), and the frequency of an applied AC signal. Generally speaking, a small value capacitor will pass a high frequency, but it will not pass a low frequency. A large value capacitor, however, can pass very low frequencies. In other words, capacitors exhibit a sort of "AC resistance," which we call *reactance*. That is why 10- or 250-pF capacitors are used in antenna tuners for VHF and HF, while 200- to 5000-µF capacitors (rather than .01 µF) are used as filters in (60 Hz) power supplies. (I'll expand on how capacitors act like low value resistances to AC in next month's discussion of power supplies.)

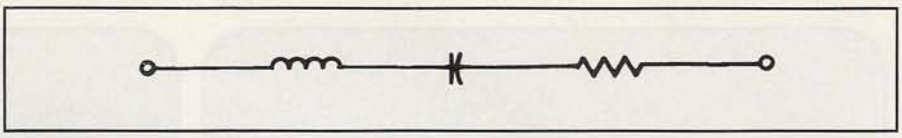


Figure 1. Since antennas exhibit properties of capacitance, inductance, and resistance, they are electrically equivalent to a series tuned circuit. At resonance, the coil's reactance and the capacitor's reactance cancel and leave only the (radiation) resistance. See discussion in text.

Coils, or inductors, differ from capacitors in that they pass DC and block or "choke out" AC. The amount of AC choked out depends on the coil's value, measured in milliHenrys (mH) or microHenrys (µH), and the frequency of the applied AC signal. A small value coil can choke high frequencies, whereas a large value coil is necessary to choke low frequencies. As an example, a small choke is usually located between a transmitter's RF amplifier section and its DC input socket. This choke prevents RF energy from reaching the power supply. As another example, old-style power supplies used with vacuum tube rigs often included a large and expensive inductor or choke to remove small amounts of AC hum not removed by large filter capacitors.

Since chokes are quite expensive, many new-style power supplies use larg-

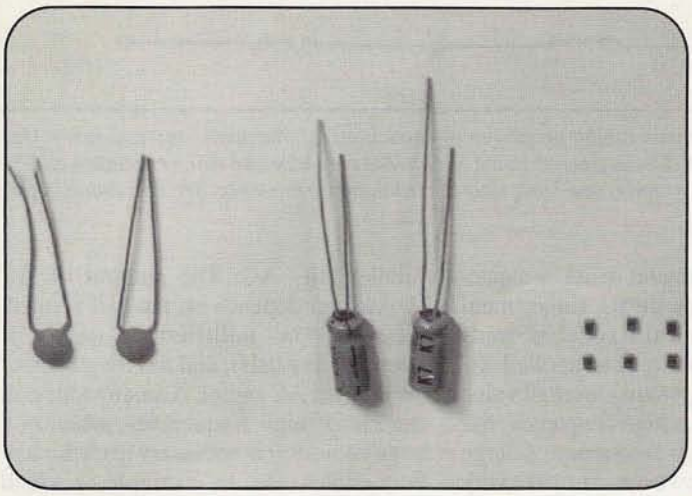


Photo C. Three popular types of "fixed" capacitors: disc (for RF and bypass applications), electrolytic (typically used in power supply-related circuits), and "chip" capacitors for SMT.

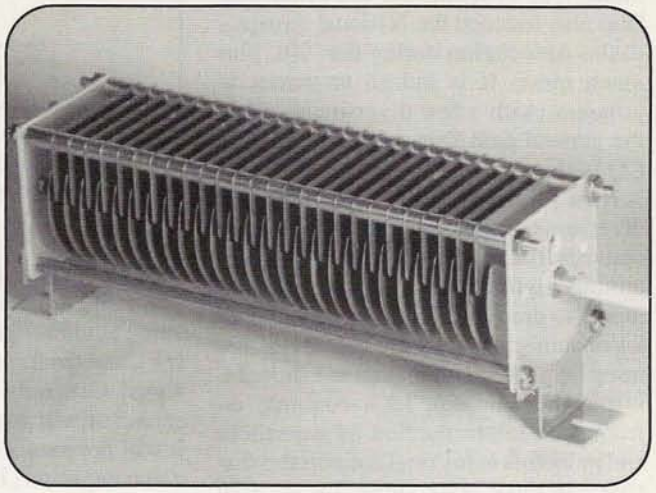


Photo D. Traditional style of variable capacitor. Fixed plates are called stator; adjustable plates that mesh in it are called rotor. The number of both types of plates influences total capacity.

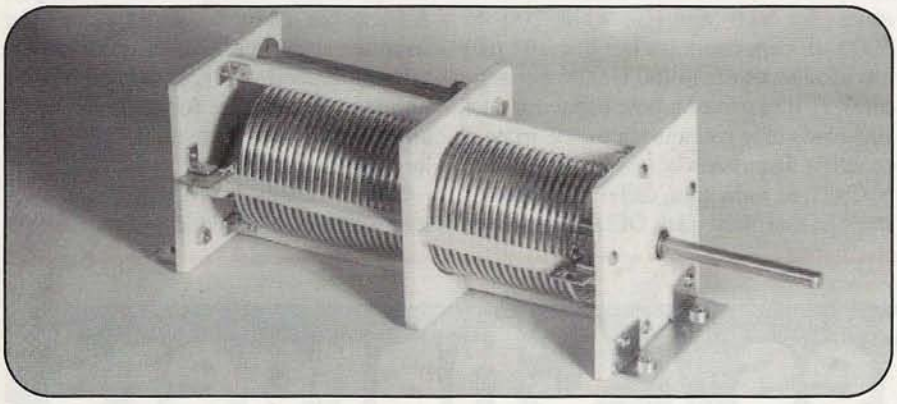
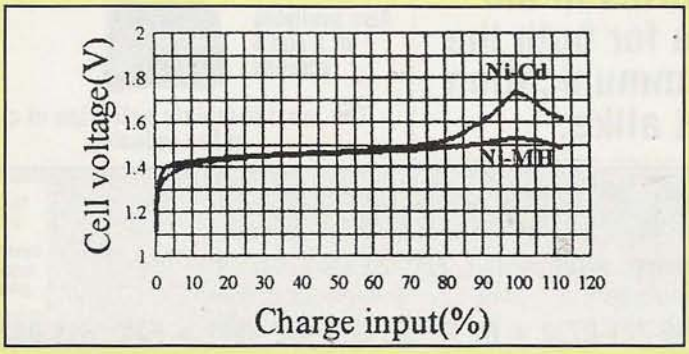


Photo E. Inductors used with antenna tuners are wound on a form or left open-air style. They may be made adjustable by turning the coil while a small metal wheel "rides" in between turns.

Oops...

Last month's article, "An NiMH Warning: Don't Toast Your Battery!" by Gordon West, WB6NOA, contained an incorrect graph. What was supposed to show the charging curves of nickel metal hydride (NiMH) versus nickel cadmium (NiCd) batteries—and the voltage "elbows" at full charge (the "elbow" is much more pronounced in a NiCd than an NiMH, making it easy for a NiCd charger to miss the full-charge point on an NiMH cell)—actually showed the comparative discharge curves of the two types of cells. The correct graph, still courtesy of NEXcell Battery Co., Ltd., appears here. We apologize for the error.



er filter capacitors and active regulators rather than including a choke. Some popular types of capacitors and inductors are shown in Photos B through E to help you identify them in amateur radio gear.

At this point, you might understandably ask why, if different value capacitors and inductors exhibit different AC resistances or "reactances," is one rather than the other is used in a circuit. Without delving into heavy technical details, a capacitor's capacity reactance (Xc) can be used to cancel a coil's inductive reactance (Xl) (*that's a capital "X" and a small "L," not a number "1"—ed.)* and vice versa. This is because properties of the two reactances are opposites in phase relationships (See "Technically Speaking," elsewhere in this column). When or where are such "cancellation effects" beneficial? An antenna tuner is a familiar example, but before discussing how tuners work, let's consider when and why one is needed.

Antennas: Large Tuned Circuits

Although we visualize antennas as radiators and interceptors of signals, our transceivers "see" them as series-tuned circuits (see Figure 1). How so? The length of an antenna's wire or driven element is its inductance, and the distance or spacing between its wire or driven element and ground (plus other nearby objects) is its capacitance. When those two opposite reactances (Xl and Xc) are equal, the antenna is said to be *resonant*.

When an antenna is resonant, it cheerfully accepts RF energy routed or cabled

Technically Speaking

As mentioned in the main text, capacitive and inductive reactances are opposites in phase relationships and (assuming equal values) one can cancel the other. How so?

The time required for a capacitor to store a charge as electrostatic lines of force causes a phase shift, or delays applied voltage 90 degrees with respect to applied current (illustrated vectorially in Figure 2A). Likewise, the time period required for an inductor to store energy as expanding lines of electromagnetic force delays applied current 90 degrees with respect to applied voltage (Figure 2B). A resistor does not produce an electromagnetic or electrostatic field, thus its applied voltage and current remain in phase. Current remains constant and voltage divides among components in a series circuit, thus current is a reference vector.

Figure 2C shows a resistor's in-phase current as a reference vector overlaying capacitance and inductance. El and Ec are 180 degrees apart; if the length of their vectors (their out-of-phase voltages) are equal, they cancel and only the resistor's in-phase voltage and current remain. An easy way to remember phase relations is "Eli The Ice Man"—voltage is ahead of current in a coil and current "comes before voltage" in a capacitor.

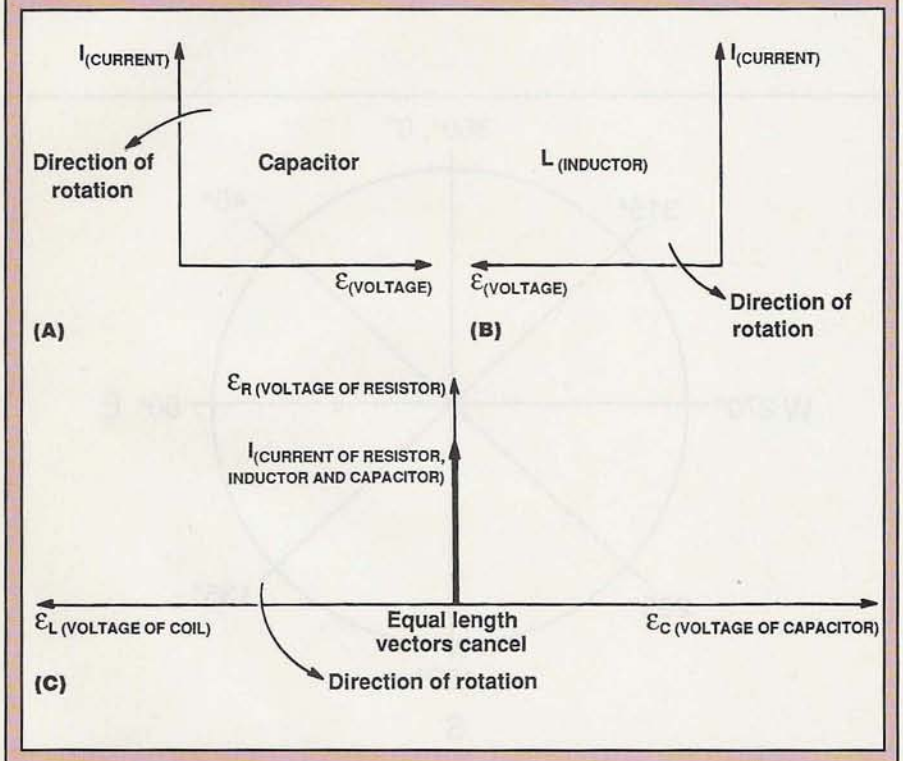


Figure 2A. The time required for a capacitor to store a charge causes its voltage to be 90 degrees out of phase with its current. Figure 2B. The same time delay in an inductor causes its voltage to lead its current by 90 degrees. Note that the inductor's voltage (El) is 180 degrees out of phase with the capacitor's voltage (Ec) in Figure 2A. Figure 2C. Put Figures 2A and 2B together and you see that El and Ec cancel each other out in a resonant circuit, leaving you with the voltage of the resistor (Er), which remains in phase with the constant current of the inductor, capacitor and resistor.

to it from a transmitter or transceiver. Ah, but exact resonance is quite difficult to achieve in reality, and it is only maintained over a very limited frequency range. When an antenna is not precisely resonant, a portion of its (cabled-in) RF energy is reflected back through its feedline or cable to the transceiver. The ratio of forward to reflected power is what we call *SWR* (Standing Wave Ratio) and, as you know, SWRs above 1.6:1 or 2.0:1 (depending on your rig) cause a transceiver or amplifier to "cut back" or reduce its power output for self-protection. When that happens, we have three general options: live with the high SWR and reduced output (pity the little rig!), readjust the antenna's dimensions and matching sections, or add an antenna tuner.

"The length of an antenna's wire or driven element is its inductance, and the distance or spacing between its wire or driven element and ground (plus other nearby objects) is its capacitance."

"Ah, but commercially-made antennas are resonant and pretuned," you say: "I just adjust it to my preferred operating range and install it, right?" Maybe, maybe not (As "Dirty Harry" says, "Do you feel lucky, kid?"). Manufacturers strive to cut their antennas' dimension for mating with "average" amateur radio applications, but every installation is unique. One antenna might be installed on a roof or chimney, another might be on a tower 50 or 70 feet high, one might be near (or in!) trees, one might parallel metal siding on a house or another antenna, and ground conductivity can vary in each case. All such factors alter an antenna's Xl/Xc balance, shift its resonant frequency, and thus produce an above-normal SWR.

An antenna tuner solves the problem. It does not "retune your antenna" so to speak, but lets you add an adjustable amount of inductive or capacitive reactance to cancel undesired capacitive or inductive reactance at the transceiver's end of the feedline/coax cable. Your transceiver then "sees" an optimum match and comfortably delivers its full output power to the antenna system—that is *if* the antenna's radiation resistance is near 50 ohms.

Whaddaya Mean, IF?

Is your antenna's impedance 50 ohms? "Aren't all popular styles of antennas 50 ohms?" you reply. Stay tuned! Next month's column has some interesting answers to those questions. Meanwhile, drop me a note and tell me some of the topics or areas you would like to see covered in this "How It Works" column.

73, Dave, K4TWJ

Pass Predictions: The Ups and Downs of Satellite Band Openings

One nice thing about satellite communications is that you can accurately predict when a particular satellite will be available for communications. This article explores ways of making pass predictions easier.

This month's column was inspired by an e-mail message from *CQ VHF* Editor Rich Moseson, W2VU. Rich sent me the e-mail after a phone conversation with *Project Corner* columnist Dave Ingram, K4TWJ. They both believe that one factor keeping some hams from using satellites is not knowing when the satellites would be "in view" for communications and, where steerable antennas are involved, not knowing where to point them. Rich and Dave both thought it worthwhile to come up with a method that's quick, doesn't require a computer, and doesn't take a brain surgeon (OK, a rocket scientist) to figure out.

"Satellite pass predictions determine when an orbiting satellite is in view of an observer on a rotating sphere (the Earth). The observer moves with the Earth as it rotates around its axis. The satellite usually moves in a different direction and at a different speed."

Producing pass predictions that apply to everyone in a wide area like the 48 contiguous states is a difficult problem. I'll first give you a little insight into why this isn't trivial; then I'll give you a pictorial solution you can use to make rough pass

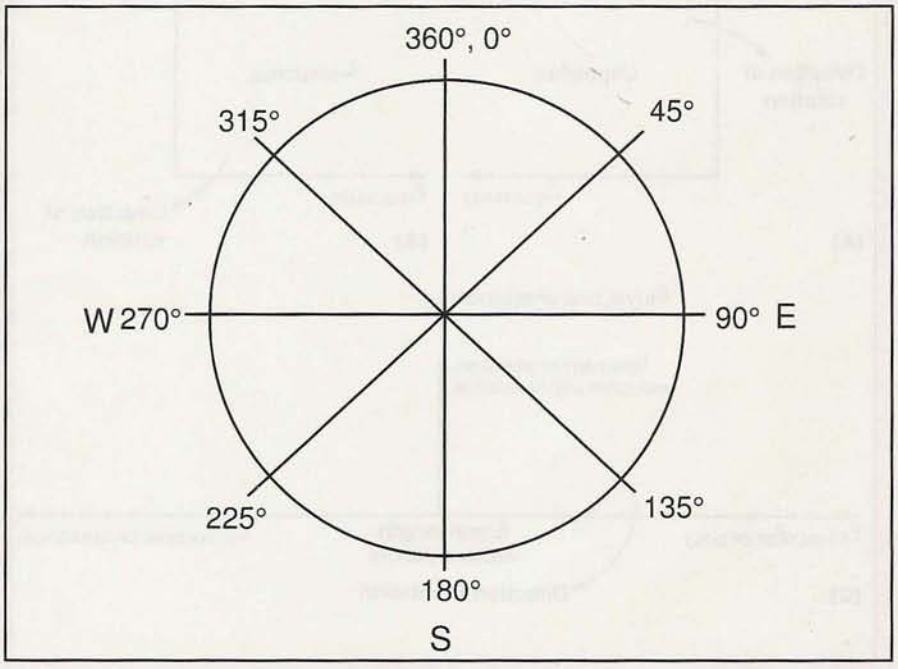


Figure 1. Azimuth Directions. Azimuth readings refer to a satellite's compass bearing relative to your location.

Table 1. AO-27[1] At-A Glance

	Frequency[2]	Mode
Uplink:	145.850 MHz	FM Voice
Downlink:	436.792 MHz	FM Voice

Notes:
1. AO-27 generally operates only in daylight on the weekends.
2. Doppler shift: for best results, offset -5 kHz early in the pass and +5 kHz late in the pass. Likewise, use -10 kHz to +10 kHz offsets for 70 cm.

By Ken Ernandes, N2WWD (n2wwd@amsat.org)

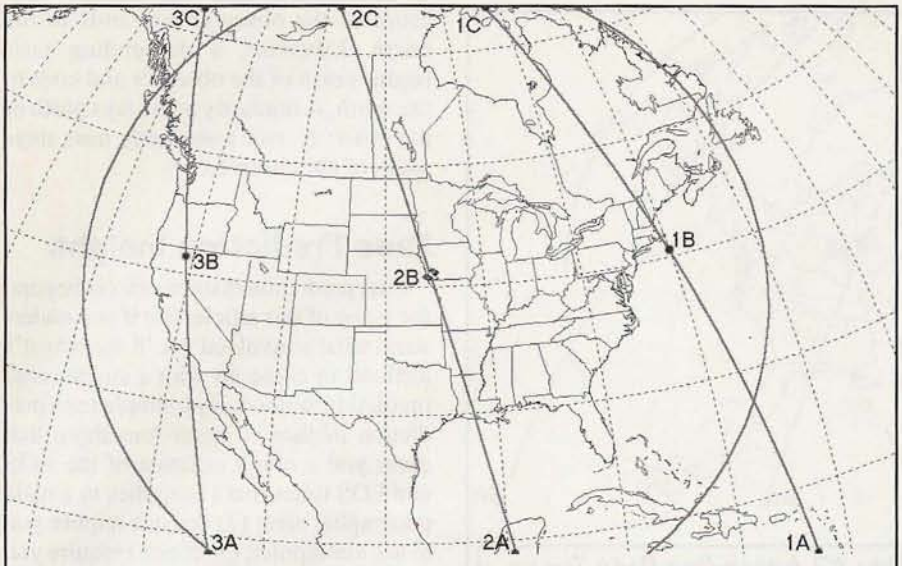


Table 2. AO-27 Repeat Interval Day #1 Ascending Pass Times

Pass Number	Pass Date	Coordinated Universal Time (UTC) A	B	C
1	April 1	02:21	02:28	02:35
2	April 1	04:03	04:09	04:16
3	April 1	05:44	05:50	05:56

Figure 2. AO-27 Repeat Interval Day #1 Ascending Passes

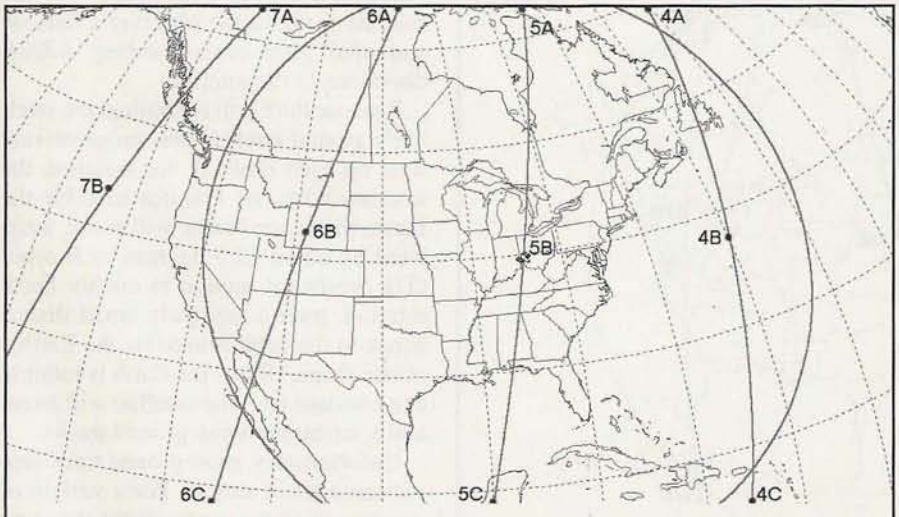


Table 3. AO-27 Repeat Interval Day #1 Descending Pass Times

Pass Number	Pass Date	Coordinated Universal Time (UTC) A	B	C
4	April 1	14:37	14:43	14:49
5	April 1	16:17	16:23	16:29
6	April 1	17:57	18:03	18:10
7	April 1	19:38	19:44	19:52

Figure 3. AO-27 Repeat Interval Day #1 Descending Passes

predictions for AO-27 and the Mir Space Station for this month. After we review this method, we'll briefly compare this with tracking software and then discuss where we go from there.

After reading this article, you should have some knowledge of predicting satellite passes. You may even have ideas on a simpler way to present the information. What's at stake? If we develop a useful method of satellite pass predictions, one that's easy enough to use, this could become a monthly part of *CQ VHF*.

Pass Prediction—Some Key Words

There are several key terms used for satellite pass predictions. These terms are helpful in understanding characteristics of satellite passes and ground site visibility. They're also important when using pass prediction reports, regardless of their origin.

The first two terms that you should be familiar with are *Acquisition of Signal* (AOS) and *Loss of Signal* (LOS). *AOS* describes the time and direction of the satellite as it rises above the ground observer's horizon. Likewise, *LOS* describes the time and direction of the satellite as it sets below the observer's horizon. A satellite's pass begins at AOS and ends at LOS.

Besides the AOS and LOS, we're also interested in the satellite's highest angle above the observer's horizon, which is known as the pass's *maximum elevation* (MAX EL). MAX EL is sometimes used interchangeably with the *Point of Closest Approach* (PCA) to the observer. The PCA is virtually the same as MAX EL for circular orbits. For elliptical orbits, however, the MAX EL usually doesn't occur at the PCA.

The *Elevation* (EL) is the satellite's angle above the observer's horizon. The EL is 0 degrees at both AOS and LOS and 90 degrees when the satellite passes directly overhead.

The *Azimuth* (AZ) is an angle describing the satellite's horizontal direction (North, South, West, East). AZ ranges from 0∞ to 360∞ with the specific directions defined in Figure 1. Thus, a 0-degree AZ is due North, a 90-degree AZ is East, a 180-degree AZ is South, and a 270-degree AZ is West.

Satellite passes can be categorized as *ascending*, *descending*, *northerly*, or *southerly*. An ascending pass begins

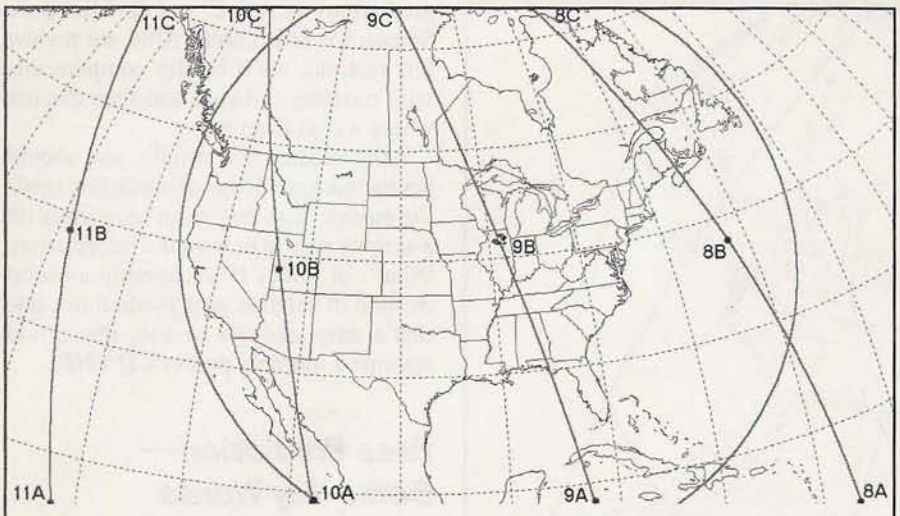


Table 4. AO-27 Repeat Interval Day #2 Ascending Pass Times

Pass Number	Pass Date	Coordinated Universal Time (UTC) A	B	C
8	April 2	01:53	02:00	02:07
9	April 2	03:35	03:42	03:49
10	April 2	05:17	05:22	05:29
11	April 2	06:57	07:03	09:00

Figure 4. AO-27 Repeat Interval Day #2 Ascending Passes

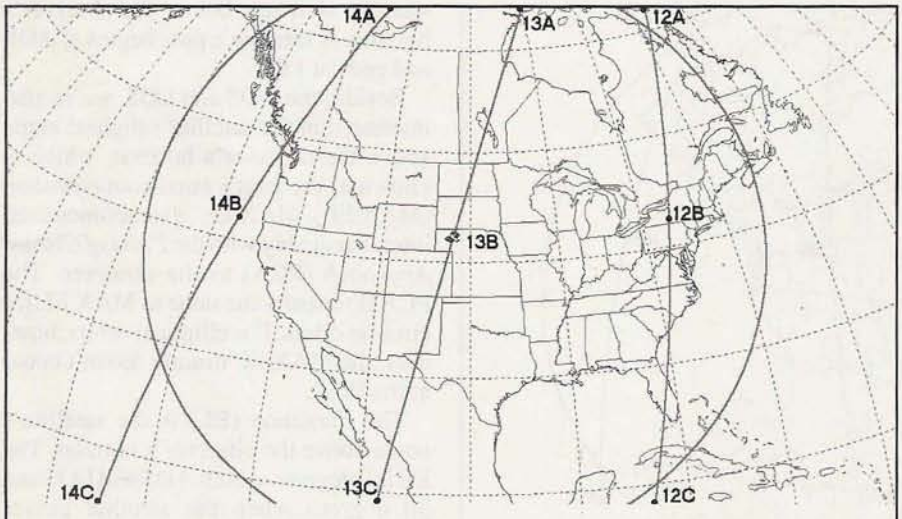


Table 5. AO-27 Repeat Interval Day #2 Descending Pass Times

Pass Number	Pass Date	Coordinated Universal Time (UTC) A	B	C
12	April 2	15:49	15:55	16:02
13	April 2	17:30	17:36	17:43
14	April 2	19:11	19:17	19:25

Figure 5. AO-27 Repeat Interval Day #2 Descending Passes

south of the observer and ends to the *north*. Likewise, a descending pass begins *north* of the observer and ends to the *south*. A northerly pass stays north of the observer, and a southerly pass stays south of the observer.

Pass Prediction Insight

Pass prediction mathematics is beyond the scope of this article. But if you understand what's involved you'll see *why* it's difficult to come up with a simple pass prediction method. By a simple pass prediction method, I mean something that gives you a rough estimate of the AOS and LOS times that (1) applies to a wide geographic area; (2) doesn't require you to use a computer; (3) doesn't require you to get outside data; (4) gives you a quick answer; and (5) is easy to use.

Satellite pass predictions determine when an orbiting satellite is in view of an observer on a rotating sphere (the Earth). The observer moves with the Earth as it rotates around its axis. The satellite usually moves in a different direction and at a different speed. Since most satellite communications are at VHF and above, the ground observer must have an unobstructed line-of-sight path to the satellite. Pass predictions give the times when the satellite is above the observer's horizon and also give corresponding AZ/EL directions to the satellite.

Because the Earth is rotating, the satellite's ground track moves progressively west on each orbit. If, for instance, the satellite takes 90 minutes to orbit the Earth, the ground track will move westward by about 22.5 degrees each orbit. (The westward motion is mainly Earth rotation, with a relatively small disturbance to the orbit caused by the Earth's oblate shape.) Since the Earth is rotating at a constant rate, the satellite will eventually repeat the same ground tracks.

Unfortunately, most ground track repetitions are not simple. For a variety of reasons, satellites rarely repeat the same daily ground track pattern. Instead, it can take days or even weeks for the pattern to repeat, and the repeat interval usually isn't a *whole* number of days.

A Pictorial Solution

The pictorial solution I'm presenting is as close as I could come to the "simple" pass prediction method I described earlier. This method provides maps with satellite ground track overlays. The selected

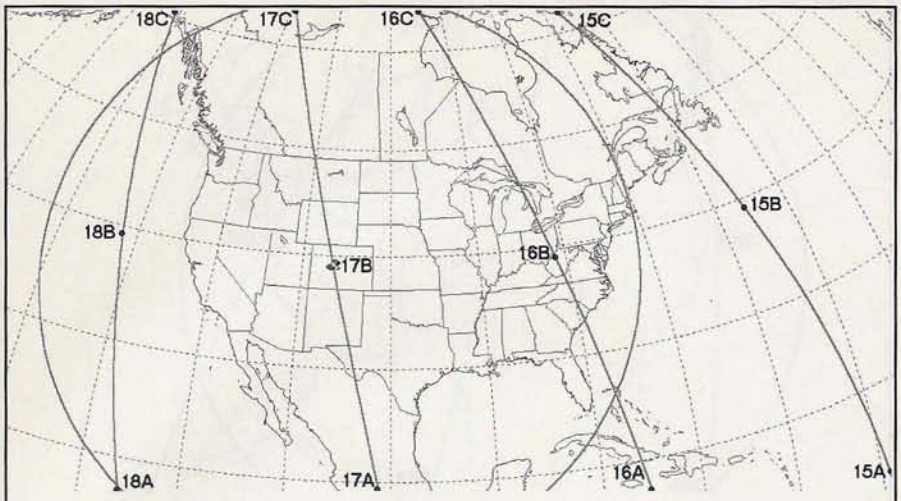


Table 6. AO-27 Repeat Interval Day #3 Ascending Pass Times

Pass Number	Pass Date	Coordinated Universal Time (UTC) A	B	C
15	April 3	01:25	01:33	01:40
16	April 3	03:08	03:14	03:21
17	April 3	04:49	04:55	05:02
18	April 3	06:29	06:36	06:42

Figure 6. AO-27 Repeat Interval Day #3 Ascending Passes

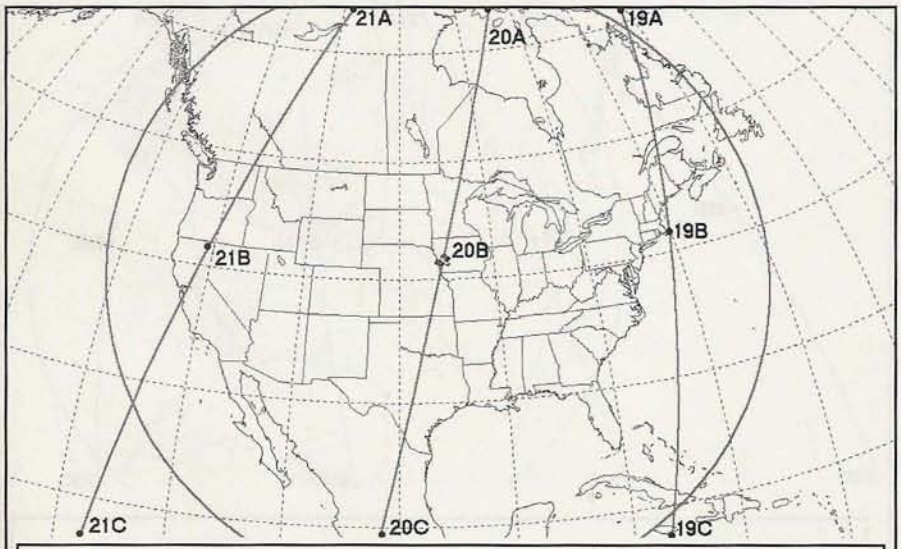


Table 7. AO-27 Repeat Interval Day #3 Descending Pass Times

Pass Number	Pass Date	Coordinated Universal Time (UTC) A	B	C
19	April 3	15:22	15:28	15:35
20	April 3	17:02	17:09	17:15
21	April 3	18:43	18:50	18:57

Figure 7. AO-27 Repeat Interval Day #3 Descending Passes

"Unfortunately, most ground track repetitions are not simple. For a variety of reasons, satellites rarely repeat the same daily ground track pattern. Instead, it can take days or even weeks for the pattern to repeat...."

ground tracks either over-fly the 48 states or pass close to the coastline. I provide enough maps to describe a reasonably close repeat cycle and also give you the time it takes for the cycle to repeat.

The satellite's Earth surface coverage, or *footprint*, is shown when the satellite is somewhere near the central U.S. By using the size of this circle as a measure, you should be able to judge which passes have some coverage for your location and also estimate your AOS and LOS positions along the ground tracks. You can estimate your AOS and LOS times by using the time references in the tables.

Consecutive passes are given on the same map, numbered sequentially, and are labeled A, B, and C. Label A is the position at which the satellite enters the map, label B is a middle position, and label C is where the satellite exits the map. The labels thus show the satellite's progression across the map.

These pass predictions were forecast last December (to accommodate the time it takes to assemble an issue of this magazine). As such, the predictions will only be accurate to a few minutes. And, because the cycle does not repeat exactly, these predictions will only be good for the month of April, 1998.

The two satellites I use in the pictorial solution are AMRAD OSCAR 27 (AO-27) (Figures 2 through 9) and the Mir space station (Figures 10 through 17). Both these satellites are low altitude and offer FM 2-meter VHF and 70-centimeter UHF access. *Note: The maps were generated with the Satellite Tool Kit (STK) version 4.0 software by Analytical Graphics, Inc. (AGI).*

AO-27

The AO-27 satellite repeats its ground track approximately every four days. The actual *repeat interval* is three days, 23 hours, and 53 minutes, or seven minutes

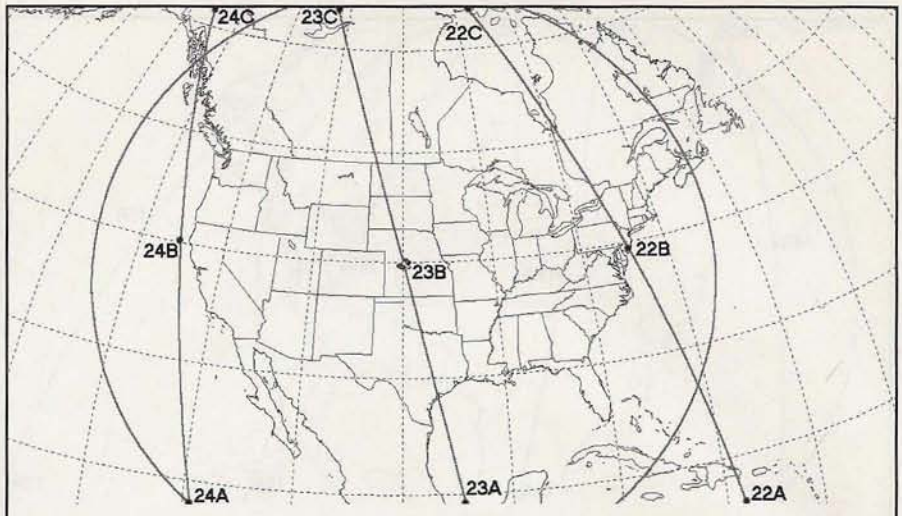


Table 8. AO-27 Repeat Interval Day #4 Ascending Pass Times

Pass Number	Pass Date	Coordinated Universal Time (UTC) A	B	C
22	April 4	02:40	02:47	02:54
23	April 4	04:22	04:28	04:35
24	April 4	06:03	06:09	06:15

Figure 8. AO-27 Repeat Interval Day #4 Ascending Passes

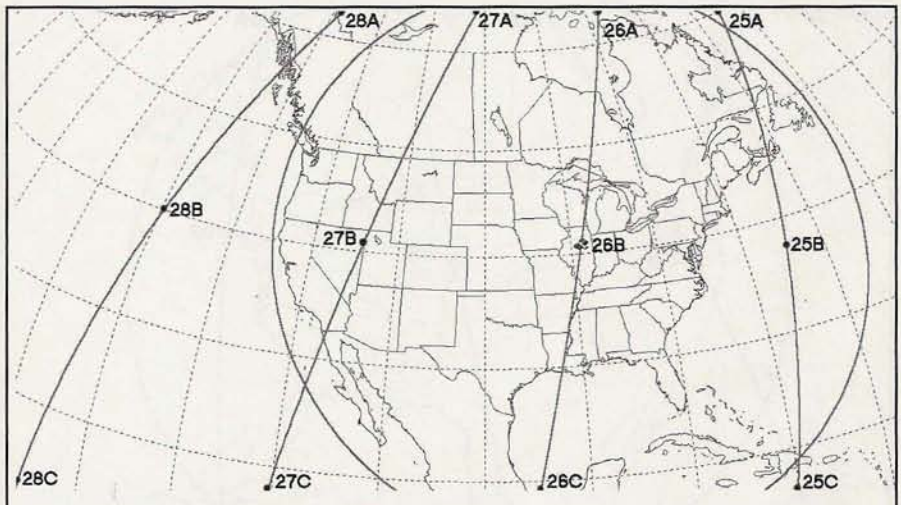


Table 9. AO-27 Repeat Interval Day #4 Descending Pass Times

Pass Number	Pass Date	Coordinated Universal Time (UTC) A	B	C
25	April 4	14:55	15:02	15:08
26	April 4	16:35	16:42	16:48
27	April 4	18:16	18:23	18:30
28	April 4	19:57	20:04	20:12

Figure 9. AO-27 Repeat Interval Day #4 Descending Passes

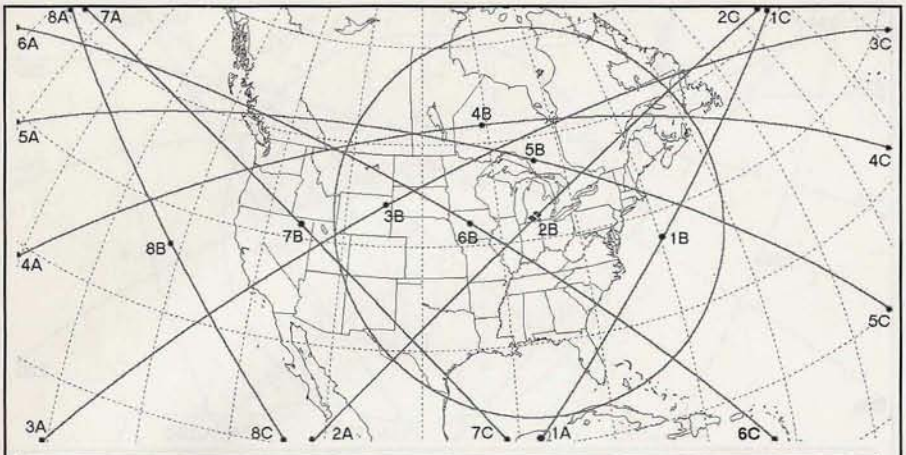


Table 10. Mir Repeat Interval Day #1 Pass Times

Pass Number	Pass Date	Coordinated Universal Time (UTC) A	B	C
1	March 31	23:32	23:38	23:45
2	April 1	01:04	01:12	01:21
3	April 1	02:34	02:45	03:02
4	April 1	04:11	04:24	04:36
5	April 1	05:47	06:01	06:13
6	April 1	07:22	07:36	07:47
7	April 1	09:00	09:09	09:17
8	April 1	10:36	10:43	10:49

Figure 10. Mir Repeat Interval Day #1 Passes

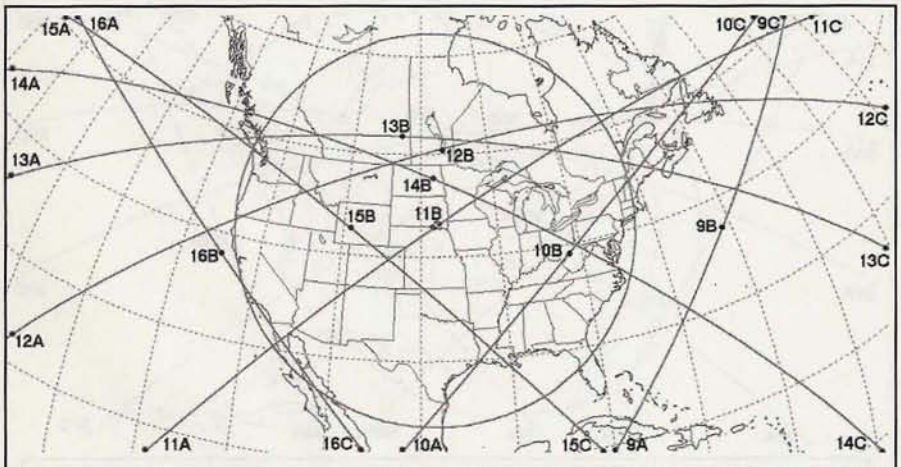


Table 11. Mir Repeat Interval Day #2 Pass Times

Pass Number	Pass Date	Coordinated Universal Time (UTC) A	B	C
9	April 1	22:33	22:39	22:46
10	April 2	00:06	00:12	00:21
11	April 2	01:37	01:46	01:59
12	April 2	03:11	03:23	03:36
13	April 2	04:47	04:58	05:12
14	April 2	06:22	06:35	06:50
15	April 2	07:59	08:10	08:19
16	April 2	09:36	09:44	09:50

Figure 11. Mir Repeat Interval Day #2 Passes

"AO-27 usually only operates on weekends when the satellite is in the sunlight. [While] it has operated on weekdays and on rare occasions, when the spacecraft is not illuminated...you should probably stay with daytime passes on the weekends."

less than four days. AO-27 is in a *polar orbit*, so the satellite will only have ascending and descending passes for stations on the maps. Figures 2 through 9 give the ascending and descending passes for the four days of AO-27's repeat cycle. Their accompanying tables give the first time each pass occurs in the month. You can compute subsequent pass times by adding the repeat interval to the table values.

AO-27 orbits the Earth every 101 minutes. Each ground track is 25.2 degrees west of the preceding ground track, which is mainly the amount the Earth rotates during one of AO-27's orbits. Notice also that AO-27's descending passes occur roughly 12 hours from the ascending passes.

AO-27 usually only operates on weekends when the satellite is in the sunlight. However, it has operated on weekdays and, on rare occasions, when the spacecraft is not illuminated. A full set of pass information is given for completeness, but you should probably stay with daytime passes on the weekends.

Mir Space Station

The Mir space station repeats its ground track every seven days, 20 hours, and 48 minutes. Since Mir's maximum latitude is about 52 degrees, stations in the contiguous 48 states can have ascending, northerly, or descending passes (usually in that sequence). Figures 10 through 17 give the daily passes for the eight days of Mir's repeat cycle, and their corresponding tables give the first time each pass occurs in the month. As with AO-27, you can compute subsequent pass times by adding the repeat interval to the table values.

Mir orbits the Earth every 92.4 minutes. Each ground track is 23.4 degrees

On the Cover

Steven K. Roberts, N4RVE, pauses in a Silicon Valley park with his 105-speed 580-pound bicycle, *BEHEMOTH (Big Electronic Human-Energized Machine, Only Too Heavy)*. He traveled 17,000 miles around the U.S. between 1983 and 1991 on this solar-powered mobile ham shack with satellite Internet link, writing and consulting for a living. Console computer systems are operated while riding via handlebar chord keyboard and ultrasonic head mouse; configuring the Outbacker dipole vertically allows mobile HF operation with an ICOM 725, along with multimode 2-meter/70-centimeter activity via Yaesu 290 and 790. A few years ago, Steve even managed a (perhaps the only) bicycle-mobile satellite contact via OSCAR-13!

The recumbent bicycle also carries a security system with six levels of sensors ranging from a 10-GHz proximity detector to a sensor that detects a change in GPS (Global Positioning System) coordinates without the correct password (at which time the bicycle control processor dials 911 and says, via synthesizer, "Hello. I am a bicycle, and I am being stolen. My present position is...")

Roberts first gained national attention with his "Winnebiko" tour of America in the early 1980s. BEHEMOTH, off the road since 1991, is now in its last full year of accompanying Roberts on speaking tours, and is going on loan to the Tech Museum of Innovation in San Jose, California. Steve's next project, which has been under development since 1992, involves a pair of pedal/solar/sail micro-trimarans (boats something like catamarans)—dubbed Microships—on which Roberts and his partner, Lisa KF6NWO, will carry their technomadic adventures to the world's coastal and inland waterways. For the first published look at Microship internal details, see this issue's cover story, "Ship of Dreams." (Cover photo by Larry Mulvehill, WB2ZPI)

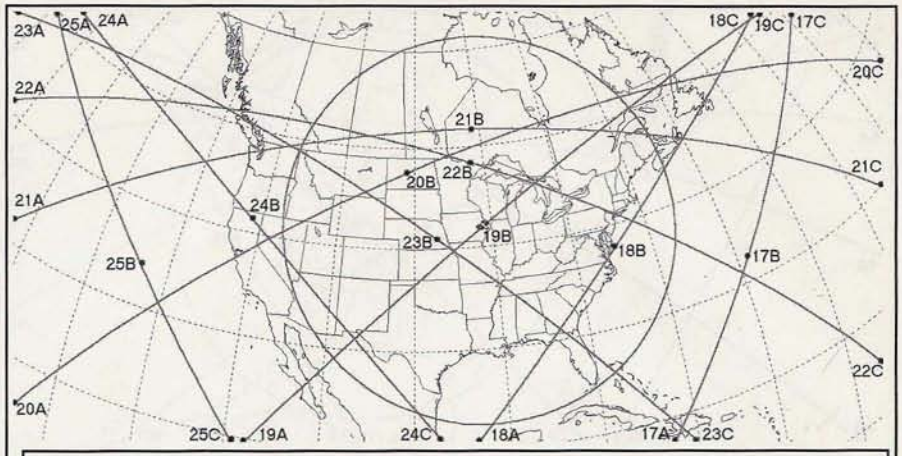


Table 12. Mir Repeat Interval Day #3 Pass Times

Pass Number	Pass Date	Coordinated Universal Time (UTC) A	B	C
17	April 2	21:34	21:39	21:46
18	April 2	23:07	23:13	23:21
19	April 3	00:39	00:47	00:57
20	April 3	02:09	02:22	02:37
21	April 3	03:47	04:00	04:12
22	April 3	05:23	05:36	05:49
23	April 3	06:58	07:12	07:21
24	April 3	08:36	08:44	08:51
25	April 3	10:12	10:19	10:24

Figure 12. Mir Repeat Interval Day #3 Passes

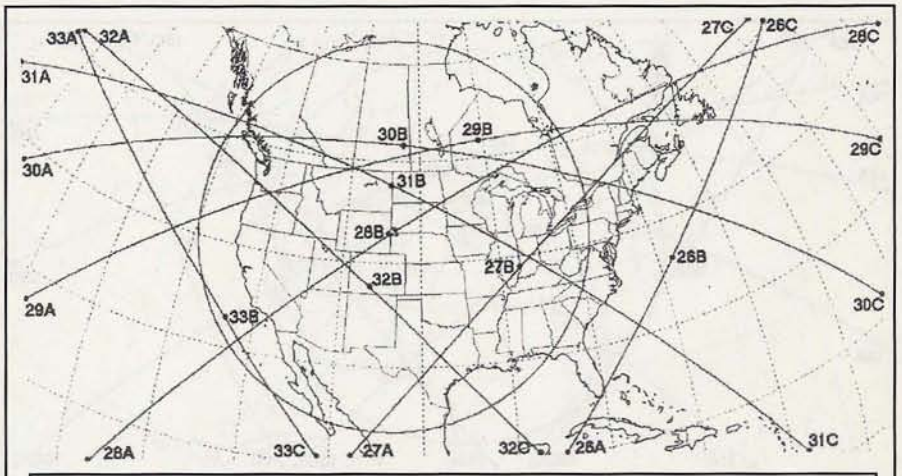


Table 13. Mir Repeat Interval Day #4 Pass Times

Pass Number	Pass Date	Coordinated Universal Time (UTC) A	B	C
26	April 3	22:08	22:14	22:21
27	April 3	23:40	23:47	23:57
28	April 4	01:11	01:21	01:38
29	April 4	02:47	03:00	03:12
30	April 4	04:23	04:34	04:48
31	April 4	05:58	06:10	06:24
32	April 4	07:36	07:47	07:53
33	April 4	09:12	09:21	09:25

Figure 13. Mir Repeat Interval Day #4 Passes

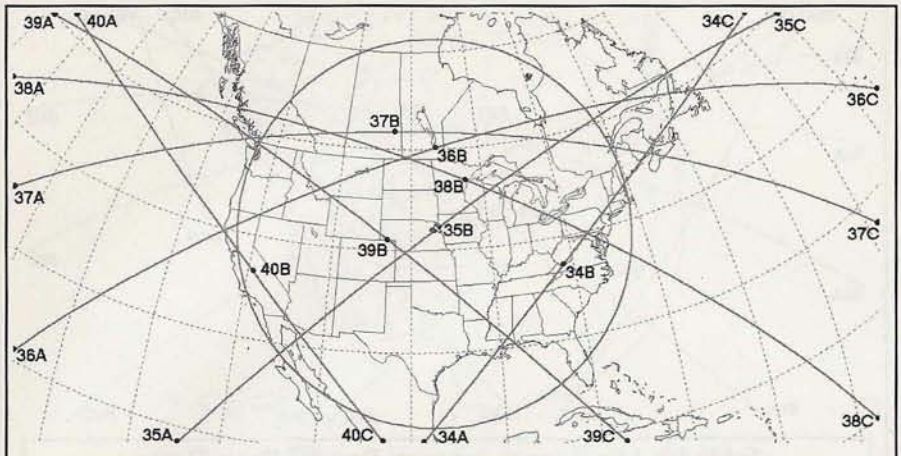


Table 14. Mir Repeat Interval Day #5 Pass Times

Pass Number	Pass Date	Coordinated Universal Time (UTC) A	B	C
34	April 4	22:42	22:48	22:57
35	April 5	00:13	00:22	00:34
36	April 5	01:46	01:59	02:13
37	April 5	03:23	03:34	03:48
38	April 5	04:59	05:12	05:26
39	April 5	06:35	06:47	06:55
40	April 5	08:12	08:21	08:27

Figure 14. Mir Repeat Interval Day #5 Passes

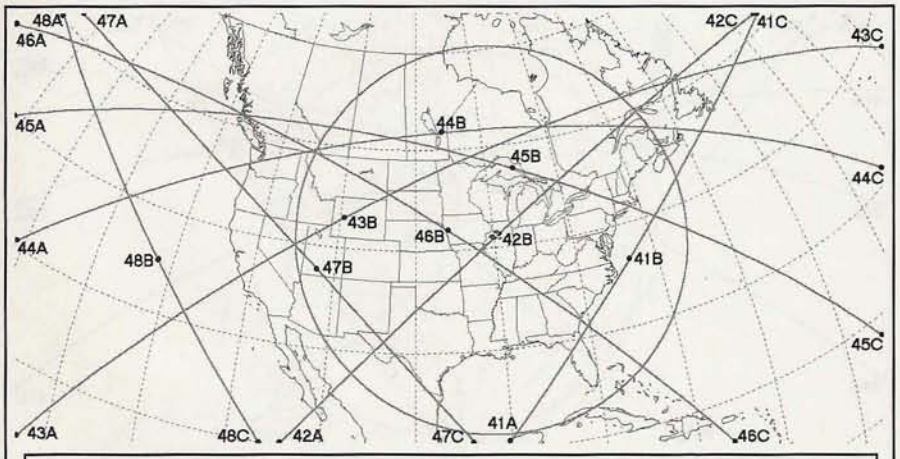


Table 15. Mir Repeat Interval Day #6 Pass Times

Pass Number	Pass Date	Coordinated Universal Time (UTC) A	B	C
41	April 5	21:43	21:49	21:57
42	April 5	23:15	22:23	23:33
43	April 6	00:45	00:56	01:13
44	April 6	02:23	02:35	02:48
45	April 6	03:59	04:13	04:25
46	April 6	05:34	05:48	05:58
47	April 6	07:12	07:22	07:28
48	April 6	08:47	08:55	09:01

Figure 15. Mir Repeat Interval Day #6 Passes

West of the ground track for the preceding orbit, which is mainly the amount the Earth rotates beneath it during one of Mir's orbits. The pass predictions for Mir will be less accurate than those for AO-27 for two reasons. One reason is that Mir orbits in the thin upper limits of the Earth's atmosphere, so its orbit changes slightly over time due to drag effects. The orbital computations used to predict the passes compensate best for drag when making short-term predictions. The other reason is that the Mir periodically fires its maneuvering thrusters to gain back altitude lost to atmospheric drag. This causes an additional change to the orbit that can't be considered in the orbital computations (since we don't know when they'll happen). Because of the three-month difference between the time I made the maps and the time you'll be tracking Mir, I recommend you allow five to 10 minutes in either direction (early and late) to compensate for the orbital uncertainty.

Pictorial Method versus Tracking Software

The pictorial tracking method gives you a way to estimate the pass times for AO-27 and the Mir space station for this month. The pictures and charts should provide enough information for stations on the maps to determine their pass times within a few minutes without the help of a computer.

However, a computer with tracking software has some advantages over the pictorial method. First, it can be tailored to your geographic coordinates so it computes passes only for your location. Second, it's much more accurate since you can use the most current orbital data (downloaded from the Internet or packet radio) and make precise short-term predictions. Finally, with tracking software,

"I'd like to hear from those of you who currently are not on the satellites, but might like to become satellite users. Which is more appealing to you: a manual prediction method similar to what I've shown, or an easy-to-use computer program?"

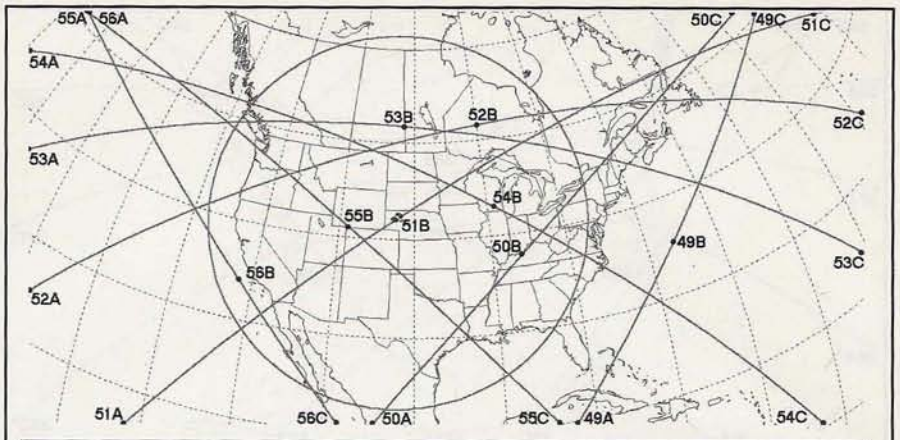


Table 16. Mir Repeat Interval Day #7 Pass Times

Pass Number	Pass Date	Coordinated Universal Time (UTC) A	B	C
49	April 6	20:44	20:50	20:57
50	April 6	22:17	22:23	22:33
51	April 6	23:47	23:57	00:12
52	April 7	01:22	01:36	01:48
53	April 7	02:59	03:10	03:24
54	April 7	04:34	04:49	05:01
55	April 7	06:11	06:22	06:30
56	April 7	07:48	07:57	08:02

Figure 16. Mir Repeat Interval Day #7 Passes

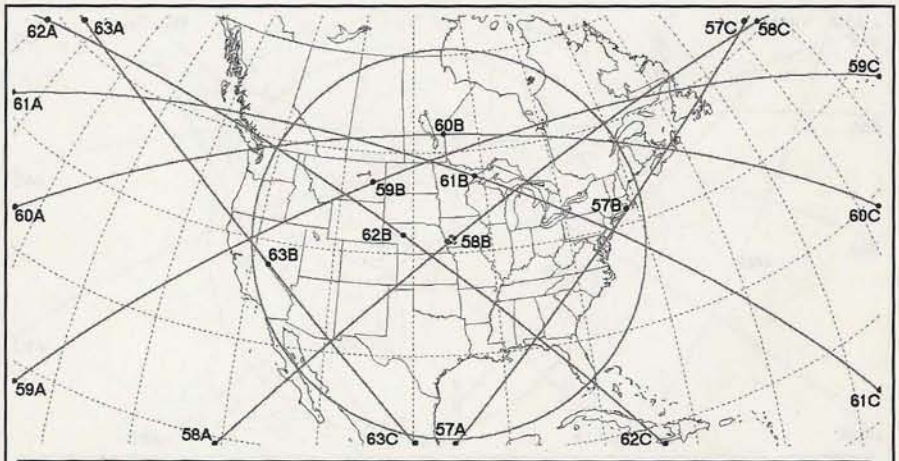


Table 17. Mir Repeat Interval Day #8 Pass Times

Pass Number	Pass Date	Coordinated Universal Time (UTC) A	B	C
57	April 7	21:18	21:26	21:33
58	April 7	22:50	22:58	23:10
59	April 8	00:22	00:33	00:49
60	April 8	01:59	02:11	02:24
61	April 8	03:35	03:48	04:01
62	April 8	05:10	05:23	05:32
63	April 8	06:47	06:57	07:03

Figure 17. Mir Repeat Interval Day #8 Passes

Table 18. Mir[1] At-A-Glance

	2-m Crew Frequencies[2] (N. America)	Alternate[3] 2-m Crew Frequencies	70-cm Crew Frequencies[4]	SAFEX Repeater Frequencies
Uplink:	145.985 MHz	145.200 MHz	435.725 MHz	435.750 MHz
Downlink	145.985 MHz	145.800 MHz	437.925 MHz	437.950 MHz
CTCSS	--	--	151.4 Hz	141.3 Hz

Notes:
1. All frequencies use FM mode.
2. Doppler shift: for best results on 2 meters, offset by -5 kHz early in the pass and by +5 kHz late in the pass.
3. These frequencies are generally used for locations other than North America.
4. Doppler shift: for best 70-cm results, use -10 to +10 kHz offsets.

you don't need to do any manual computations. Once you're set up, pass predictions are relatively effortless.

One further thought on pass prediction computer software programs—they can be made easy-to-use. There is a good example of an on-line Internet program that does pass predictions for major cities. The Web address for the *Satellite Tracking Prediction Form* is <http://acsprod1.acs.ncsu.edu/scripts/HamRadio/sattrack>. If you have Web access, give this one a try.

Where We Go from Here?

The purpose of this article is to try to find ways to make it easier to predict satellite passes, especially for first-time users and those without a computer. I provided the pictorial tracking solution as a "first cut" example, hoping that somebody will offer suggestions for improvements so we can present useful tracking information that applies to a wide geographic area, is reasonably compact, and is not overly laborious to produce.

Am I on the right track with this project? I'd like to hear from those of you who currently are *not* on the satellites, but might like to become satellite users. Which is more appealing to you: a manual prediction method similar to what I've shown this month, or an easy-to-use computer program? What improvements would you like to see to either or both of these methods?

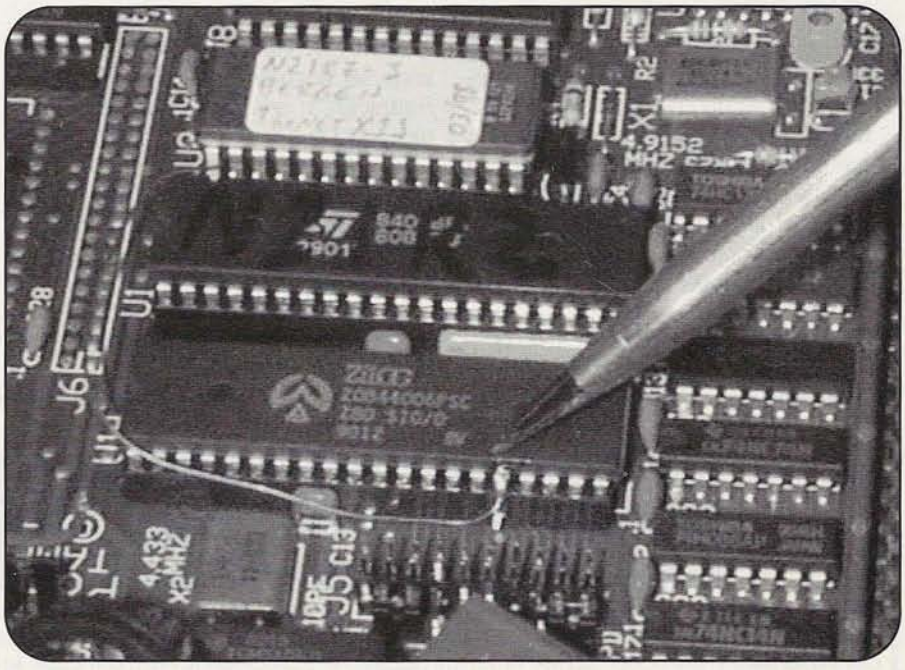
For comments, please contact me by a regular mail (I'm current in the *Callbook*) or at the *CQ VHF* mailing address. I will accept *brief* e-mail messages, but will consider them as coming from somebody with both a computer and Internet access. I'm most interested in comments from those who are looking for an easier way to do satellite pass predictions. ■

Packet Networking—Part 1: TheNET

We begin our series on the various types of packet networking software with the most popular system on the air today: TheNET X1J.

TheNET X1 packet networking software is arguably the most popular amateur networking software in the world. There are very few places where it isn't in use, and there's a reason for that, actually two: it's free and it works well. While far from optimum, its ease of setup and use, combined with its flexibility and relative lack of bugs, have made it extremely popular.

Last month, we began this series with overviews of most of the major networking software available to the amateur community. This month, we'll go through all of the steps needed to put a TheNET X1J packet network node on the air. The only thing you really need is a PC-compatible computer and a willingness to read. The details for each reference are in the "Resources" section at the end of the column.



A close-up of a Tiny-2 with pin 16 of the SIO connected to pin 1 of the EPROM, a modification required to run TheNET X1J. Note that the respective pins are bent out from the socket to ensure that they're completely disconnected from the rest of the circuit. You can unmodify the TNC by removing the wire from the EPROM.

Advantages of TheNET X1J

We'll be looking exclusively at the X1 series of software, version J (known as X1J), instead of others that are available. I strongly recommend using the X1 series, as opposed to the older and less powerful TheNET Plus series or the German Nord><Link version. Despite requiring a minor (and reversible) modification to some TNCs, X1J uses a 512 kilobit EPROM (Erasable Programmable Read-Only Memory) instead of a 256 kilobit, allowing for nearly twice the number of features.

The first step is to get a copy of the software. It's available on-line from AOL, CompuServe, lantz.com, and other places. If you don't have Web access, Buck Rogers, K4ABT (the packet columnist for *CQ* magazine) will send you a copy of the software, along with two free packet radio handbooks and some other goodies, all for $5 and your return address. This covers the cost of Priority Mail, the floppy, and handling. Since the software has been in its present form and version for a few years now, it should be fairly easy to find locally. You might even ask your local node sysop.

Once you've copied the software's .ZIP archive to your hard disk and expanded it, you'll end up with over three dozen files. These are mostly documentation files, which are well written, very useful, and plentiful (they would take up over a hundred pages, if printed). The important files are **PATCH.EXE** and the two binary image files, **THENET1.X1J** and **THENET2.X1J**. The rest are some utilities for older EPROM formats (Intel and Motorola) and the source code. Take these three files and copy them into another directory to make them easier to work with.

A note on TNCs is in order here: TheNET is made to run on a TAPR TNC-2 compatible TNC *ONLY*—it won't work in anything else. Well, there is a version

By Don Rotolo, N2IRZ (73227.2644@compuserve.com)

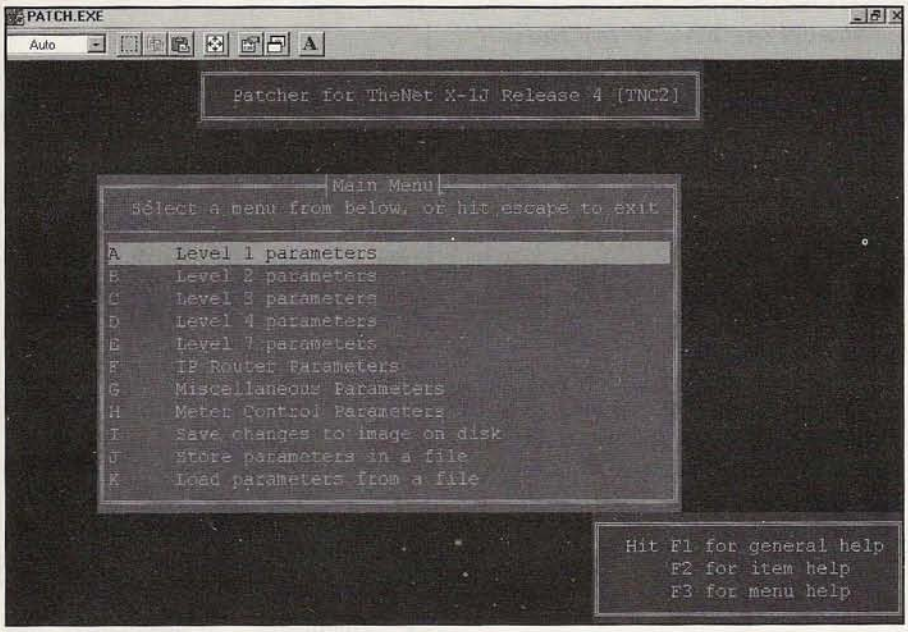


Figure 1. The main screen of PATCH.EXE. You use this program to create the data files to program an EPROM, which teaches your TNC to become a network node. From this screen, you enter sub-menu screens, where you can change individual parameters, load in a pre-made parameter file, and save your work. Written for DOS, it also runs under Windows™ (but it runs better under DOS).

for the Timewave/AEA PK-96, but that's the only exception. That means, in a practical sense, that only the MFJ-1270 and PacComm Tiny-2/Spirit-2 series are useful. TheNET simply won't work with products from Kantronics, Timewave/AEA, BayCom, and so on. There are a few I haven't mentioned that *are* TNC-2 compatible, so contact the manufacturer if you're not sure. (*Just to be clear, there is no suggestion here that there's anything wrong with the packet products mentioned above, only that TheNET software isn't compatible with them.—ed.*)

Setting Up the Software

Now, we have to generate the binary image files which hold all the specific data for our node. There are a number of useful data file templates available at the NEDA Web site (again, see "Resources"), which are already pre-loaded with a good selection of parameter values for User ports, point-to-point links, and LAN (Local Area Network) ports. It's important to get the parameters right because, if they're not, the node will perform poorly at best; at worst, it will hurt the rest of the network. For those of you without Web access, NEDA will send a printed list if you send them an SASE (self-addressed stamped envelope).

If you don't want to wait, you can create your own default datafile. To do this, run **PATCH.EXE** (run it under DOS; it will run under Windows™, but tends to crash the computer more easily). When the program starts, you'll see the opening screen shown in Figure 1. To create the default data file, select option **J** (Store parameters in a file), and name the file **DEFAULT.TXT** when prompted. Press the **<Esc>** key, then answer **Yes** to exit **PATCH**.

Next, make a copy of the **DEFAULT.TXT** file, giving it a new name. In this example, we'll be making a node named **BERGEN** with the callsign **N2IRZ-3**, so I've named my new text file **BERGEN.TXT**. When selecting a node name, try to provide a clue to where the node is (for a user port), or its function (for backbone ports), using a maximum of six uppercase letters (numbers are also OK). Our node is a user port in Bergen County, New Jersey, hence the name **BERGEN**. For backbone nodes, begin the nodename with a pound sign (#) so it doesn't show up in node lists, then use two letters for the node's location, and two more letters for the other end of the link, such as **#RDLF**, for the River Dale-to-Little Ferry link. This kind of a name helps later, when troubleshooting. For the callsign, use your own, and pick a number from 1 to 14 for the SSID (Secondary Station Identifier). Try to avoid using -0 or -15, which generally designate an end-user, and use a given callsign-SSID combination only once in the network.

"If you don't own [an EPROM burner], you have three choices: buy one, find a friend with one, or send $15 to Buck Rogers, K4ABT, who will burn it for you (send him the binary EPROM image files on a floppy)."

Customizing Your Node File

Open the new text file, which will look something like Figure 2, but longer. The only absolutely required changes are to the **NodeCallsign** and **NodeAlias** lines, although it is highly advisable to edit the **InformationMessage** and **Password** lines. If you know the *TX Delay* setting for your radio, edit the **TxKeyupDelay** line—a value of 35 means 350 milliseconds. If you'll just be playing with the node, you can leave all the other parameters as they are. For serious nodes, you should get the NEDA parameter lists, ask the local sysop for his/her list, or just read the parameters from your local node (using the **PARMS** command); the format of the node's response is explained in the documentation.

Once all the settings in the text file are how you want them, save the file and run **PATCH.EXE** again. Using option **K** (Load parameters from a file) will load all the parameters from the new text file into the program in a flash. Select option **B** (Level 2 parameters) and look at the callsign on the first line to make sure the changes have actually been made. If they have, press **<Esc>** to return to the main menu, then select option **I** (save changes to image on disk). After confirming that you want to proceed with a **Yes**, you're done; press **<Esc>** and **Yes** to exit the **PATCH** program.

Now, you want to *copy* the two files **THENET1.X1J** and **THENET2.X1J** to new file names. In this case, I'm going to rename the copies **BERGEN1.BIN** and **BERGEN2.BIN**, using a DOS command like "**Copy thenet1.x1j bergen1.bin**". These are the binary EPROM images. We

"After double-checking your work, connect the TNC to the radio and power. Switch on the radio, then the TNC, and the TNC should send out a 'nodes' broadcast, telling the rest of the network that it's alive."

want the original files (**THENET1** and **2**) to remain in the same directory as **PATCH.EXE** forever, so we *never* rename them, just rename the copies.

Burning Your EPROM

Now, you have to load these two files into a blank EPROM. If you have an EPROM programmer (or "burner," as they're called), then chances are you already know basically what to do. If you don't own one, you have three choices: buy one, find a friend with one, or send $15 to Buck Rogers, K4ABT, who will burn it for you (send him the binary EPROM image files on a floppy). If you want to buy one, the least expensive EPROM burner I've ever found is the Intronics unit for $130. Its advantage over the competition is that it uses the PC's parallel (printer) port (ideal for laptop use), as opposed to a plug-in card.

If you (or a friend) will be doing the programming, there's one very important trick to programming the EPROM with two (split) data files: each one must be programmed separately—you *absolutely cannot* just concatenate (combine) the two files. Normally, for a 27C512 EPROM, the buffer address runs from **0h** to **FFFFh** (the little "h" means Hexadecimal notation, that is, base 16). To program the first half of the EPROM, you must reset the buffer address range to **0h - 7FFFh**, and for the second half, to **8000h - FFFFh**. If this looks like gibberish to you, don't fret—it'll make sense later when you start working with the EPROM burner.

Preparing the TNC

OK, somehow or other, you've managed to get that EPROM programmed. Make sure you put a small label on top, noting the callsign and SSID, Nodename, and software type on it. I also put a date on it. Now, it's time to modify the TNC, if necessary.

Some newer TNCs, such as the PacComm Spirit-2, have a simple way of allowing a 512 kb EPROM to be used; in this case, just a jumper, I believe. For all others (MFJ 1270 series, PacComm Tiny-2 series, DRSI TNCs, and so on), you have to perform a simple modification. You can find detailed instructions in the (included) documentation file BANKSWIT.TXT, where it also notes that K4ABT's instructions (found at the SEDAN Web site; see "Resources") are much more clearly written.

Basically, you want to connect Pin 1 of the 512 kb EPROM to pin 16 of the Z-80 SIO (Serial Input/Output controller), and that's all. To locate the SIO (a big, 28-pin integrated circuit), look for the letters SIO on top. If it doesn't have these letters, but others, such as CPU or PIO, you've got the wrong one. Remove the ICs from their sockets, bend out pin 16 on the SIO and pin 1 of the EPROM, plug everything back in, and gently solder a wire between the two bent-out pins, as shown in the Photo.

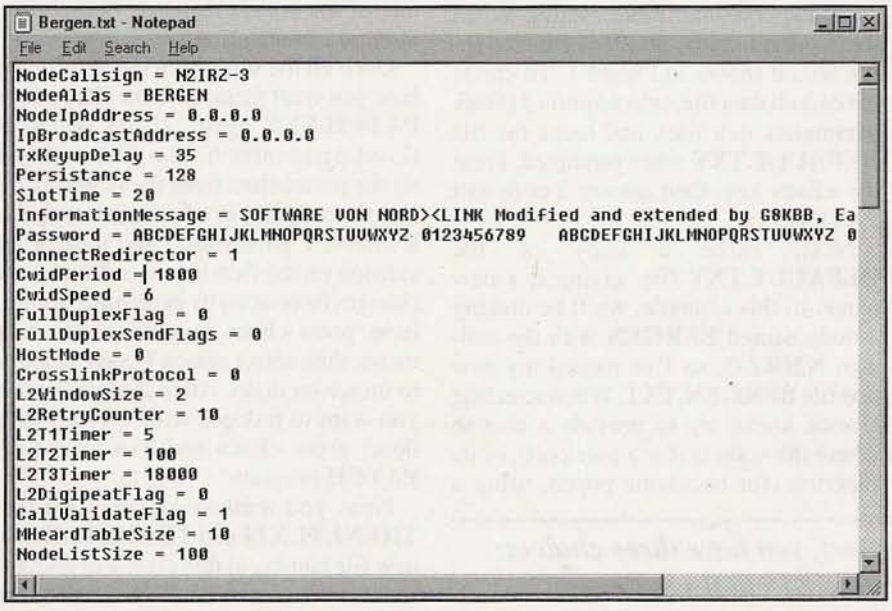


Figure 2. Here are the first few lines of the pre-made configuration data file used for the example. You must set the NodeCallsign and NodeAlias lines; all the rest are optional. What could possibly be easier?

Clarification

In my February column, I gave the impression that the APRS QSY from 145.79 to 144.39 MHz was a done deal. At the time I wrote the column, it seemed as though it would be by the time February rolled around. In the meantime, this proposal continues to be hotly debated in the APRS and weak-signal communities, and no agreement has been reached. I apologize for any misunderstandings that my assumption may have caused.

Finally, a brief update: The ARRL added its support (and a $500 donation) to the QSY plan at its January, 1998, Board meeting.

Getting on the Air

After double-checking your work, connect the TNC to the radio and power. Switch on the radio, then the TNC, and the TNC should send out a "nodes" broadcast, telling the rest of the network that it's alive. If this doesn't happen in the first minute, be patient; depending upon the settings, it can take up to 90 minutes! Once the first broadcast goes out, use another TNC and radio to connect to the node and make sure everything's working as it should be.

The first thing to check is that it accepts connect requests from you with both its nodename and callsign. Next, ask for Info, Routes, Nodes and MHeard lists (send the commands I, R, N and H, respectively)—expect these to be very short at this point, maybe just a single header line. Also check the parameters

Figure 3. Decoding a password challenge to the SYSOP command. Each letter in the password line is assigned a number. The node sends five numbers, you have to respond with the correct five characters from the password string. The correct response to "22 09 15 02 11" is "NAWHP". The password is programmed into the EPROM.

using the PARMS command. If everything checks out, you should then enter the SYSOP mode.

First, type the command **SYSOP** and, assuming you set a password, the node will answer with five numbers on a single line. What you must do to continue is determine which letters in your password correspond to those numbers, and send them back in reply. I think that an example would help here, as would an illustration, so refer to Figure 3 to make sense of the following:

Suppose our password line, which we set when we created the EPROM binary file, is "**THIS IS A PASSWORD LINE**". Note that it's in all uppercase—it doesn't have to be, but the response is case sensitive, and this makes it a *lot* easier. Now let's say that, in response to my **SYSOP** command, the node responds with a line like (without the quotes): "**N2IRZ-3:BERGEN}22 09 15 02 11**". For this particular password challenge, the correct response would be (again, without the quotes): "**NAWHP**". Now, look at Figure 3 to see how to convert the numbers to letters.

To make things just a little more confusing, the node gives you no indication as to whether or not the reply is correct. To see if you're really in Sysop mode, try changing a parameter. Type "**P**" to get a parameter list. Note the value of the first number, which is usually 100. Change it to a value of 99 by typing "**P 99**"; the node will respond with a new parameter list, and you should see that the first number has indeed changed to 99. Change it back by typing "**P 100**" (or whatever value it had).

One interesting thing to note is that the lack of positive response from the correct password challenge response is an important security feature. If someone were to listen on the channel long enough, seeing a large number of responses, it would be possible to figure out the node's password, with the possibility of making unauthorized changes. By not confirming your entry, it makes it possible for you to send any number of *wrong* answers to the SYSOP challenge, confounding any eavesdroppers, as long as *one* of the challenges was answered correctly (it doesn't matter which one)—you're in Sysop mode and the node just ignores any of your purposely misleading wrong responses. It's a good idea to include at least two wrong responses with every correct one. Also, note that the node will never send a number corresponding to a blank space in the password line.

Making It Useful

Now we have a single node on the air. Others can connect to it, but, until you add one or mode backbone ports, it isn't terribly useful. Please see the June, 1996, issue of *CQ VHF* for some theory for designing and building a network, and the July, 1996, issue covers the gory details of assembling a node site. The October, 1996, issue explains how a diode matrix (the basic building block of a node site) works, and even has a single-sided pc board etching pattern for a six-port diode matrix board.

In addition to the documentation files that come with the TheNET X1 software, NEDA has some good information concerning the care and feeding of a node. In particular, they help you to learn what each parameter or mode setting means, how it should be adjusted, how it affects performance of the node and network, and what to do when there is a problem.

Coming Up ROSEs

Next month, we'll take a look at the process for getting a ROSE switch up and running. In the meantime, I encourage you to get involved and learn the basics of networking. Even if you never actually put a node on the air, learning the process, and then watching the node in action, is a good education; you'll then really understand how a network works. After all, you never know when something will help you get a job (or keep the one you have), so get out there and start building! 73,

N2IRZ

Resources

When contacting any of these manufacturers, be sure to mention that you read about them in *CQ VHF*.

Intronics, Inc., Box 13723, 612 Newton St., Edwardsville, KS 66113; Phone: (913) 422-2094. Their "pocket programmer" is $129.95 + s/h; also ask about their EPROM eraser.

K4ABT/SEDAN—Buck Rogers, K4ABT (SEDAN network), 211 Luenburg Dr., Evington, VA 24550; <http://www.packetradio.com>. Send an SASE for the EPROM ordering form, which *must* be used. For a copy of TheNET X1J and other goodies, send $5 and your return address.

Lantz.com—Their FTP site at <ftp://www.lantz.com> carries a wealth of current and archival amateur radio software (networking, BBS, TCP/IP, APRS, and more).

MFJ Enterprises, Inc., 300 Industrial Park Rd., Starkville, MS 39759; Phone: (800) 647-1800; Fax: (601) 323-6551; Internet: <http://www.mfjenterprises.com>

NEDA (The North East Digital Association), PO Box 563C, Manchester, NH 03105; Internet: <http://www.cam.org/~burt/neda/neda.html>

PacComm Packet Radio Systems, Inc., 4413 N. Hesperides St., Tampa, FL 33614-7618; Phone: (813) 874-2980; Orders only: (800) 486-7388; Fax: (813) 872-8696.

Timewave Technology Inc./AEA, 2401 Pilot Knob Rd #134, St. Paul, MN 55120; Phone: (612) 452-5939; Fax: (612) 452-4571; Internet: <http://www.timewave.com>

EPROMs are available from most electronics supply houses. *Jameco* (Phone: 800-831-4242) is one reliable source for the 27C512-15 (150 nSec) EPROM, part number 39781.

Persistence Pays (But Not Pajamas)

If you want to learn code—even if you think you can't—start listening to the silence...and don't wear pajamas to a job interview!

Editor's Note: If you enjoyed Installment 1 of The Peter and Keith Show, *back in the February issue, when Peter talked his friend Keith out of quitting ham radio, then you'll* love *Installment 2...*

"I can't do it! It's no use. This really fries me."

"Slow down, Keith. What is it that you *are* doing?"

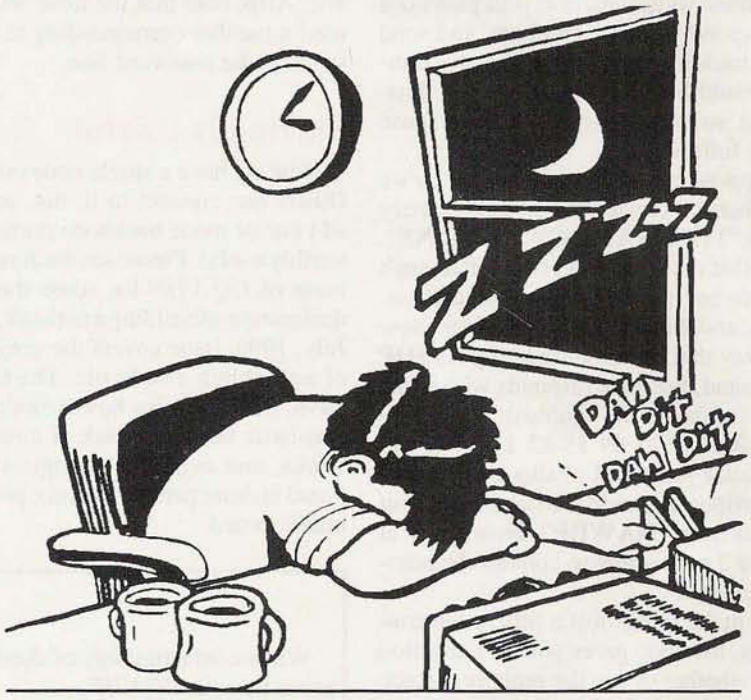
"Don't start that nonsense on me. It's not what I *am* doing, it's what I *can't* do. You know darned well what it is, you smug little..."

"Calm down. Your blood pressure is going to go sky high. I wish to heaven you would *quit smoking, now*. You'd live a lot longer. Are we talking about CW?"

"Yes, of course." Keith pretended to ignore my jab about his cigarette habit.

"Look, you have a graduate degree in engineering, don't you?"

"Yes."



"Shhh...I'm listening to the silence!"

"The height of absurdity is to do the same thing over and over again, expecting different results than what you got before. Take an approach that does not work, and do more of it. Really useful!"

"And you have built all sorts of electronic gadgets...and put a whole slew of computers together..." Keith nodded his head "yes" to all these questions even though I already knew the answers. "So, will you grant me that I'm justified in thinking that you're a reasonably intelligent human being?"

"Wipe that stupid smile off your face. Hey, I know I am no dummy. It's just that this is one area where my brain simply doesn't work."

"How do you *know* it doesn't work in this area?"

"Because I can't do code."

How Do You Know You Can't?

"How do you know you can't do code? Tell me."

"You are the most frustrating person to talk to..."

"It is a serious question. How do you know you can't do code?"

"I think it's a stupid question."

"You thought that the first time I asked you 'How do you drive?' Remember?"

"OK. You win. How do I know I can't do code? Well, the first thing is that I can't get above about seven words per minute. When it goes faster than that, I miss one character and then I miss a whole bunch more while I'm trying to figure out what I missed. I'm stuck. And I am not getting any better."

"That's right. And you won't get any better, either..."

"Thanks a lot for the vote of confidence, Peter."

"...until you start doing things differently. The height of absurdity is to do the

By Peter O'Dell, WB2D

"Forget about listening to the dots and dashes—that has gotten you nowhere. What you want to do is listen to the silence around the dots and dashes."

same thing over and over again, expecting different results than what you got before. Take an approach that does not work, and do more of it. Really useful! There is nothing wrong with you—just the way you're trying to learn code."

"OK, so how *should* I be doing it?"

"Well, start by throwing away those slow-speed code tapes. I don't think anyone should ever start out at anything less than 20 to 25 words per minute."

"But the novice test is at five words a minute. That comes a lot quicker than 20! Now who's not making any sense?"

"I grant you that the first test is at five wpm, but that doesn't mean it's the best place to start learning. That test was instituted back when the ARRL published a booklet with the dots and dashes physically drawn on the page and suggested you learn code that way. The most advanced teaching tool at the time was the Ameco LP phonograph record. Things have improved *a little* since then. But we are still victimized by the 'gosh, we've always done it that way' mentality. Anyway, what you have to do is 'unlearn' what you've learned about code before you can start doing it right."

Start by Unlearning

"That's really encouraging."

"It's a lot easier than it sounds. If you only listen to characters sent at 20 wpm or higher, it will happen much faster than you think. Look at what you've been doing. You're consciously counting the dots and dashes each time you hear a character and then sort of looking it up in your head. Right?"

"I guess so. How else could you do it when you don't know all the characters really well?"

"I think you do know them already—unconsciously. You learn much faster than you think you do. Unfortunately, you've just learned to do the wrong thing. It is as simple as this: You've just been going about this all wrong. You're trying to do it with the conscious mind. You have to let go of conscious involvement and just let your unconscious *respond*. Your conscious mind is way too slow to keep up with code above nine or 10 wpm—and that's the very top. Most people top out at seven to nine when doing it this way. Just trust your unconscious."

"OK, I guess you're making sense. And it *sounds* real nice. Just like when I go to Dr. Johnson's office and he tells me to *just* 'relax.' Heck, if I knew how to do it, I already would have. So far, you're no more help than he is. Both of you are telling me something I already know I should do. *Neither* of you is telling me how to do it."

"It's easy. Far easier than you imagine. On both accounts. Since this one might save your life, let's take care of the relaxing first. Just sit there quietly and close your eyes. Now focus your awareness on your breath as it flows in and out...that's right."

After only a minute or so, I could see that the tension was flowing out of Keith's body. "How are you feeling now?"

"Hey, this works!" Keith was excited, but the "edge" was gone from his voice.

"Of course, it does! And so do my methods for learning code."

"OK, so you've made your point. This feels good. Think I'll do it every day."

"Couldn't hurt."

"So, how do I go about *unlearning* my bad habits on CW?"

Listen to the Silence

"The first thing, like I said, is to listen only to code speeds of at least 20 wpm. Faster would probably be even better. There is a special way to listen to it, too. Forget about listening to the dots and dashes—that's gotten you nowhere. What you want to do is listen to the *silence* around the dots and dashes."

"Now, that makes no sense at all."

"On the contrary. It's actually the silence that gives each character its own distinctive sound, its distinctive rhythm. In other words, it's the silence that gives the character its meaning. You'll automatically start recognizing characters as characters when you focus on the silence. When you're listening to someone talk, you listen for words, right? Each word has its own rhythm, its own sound. You don't sit down and attempt to break a word down into component sounds in some misguided hope of deciphering its meaning. You understand the spoken word as a whole unit. Well, code is the same way. And when you get really fast, you'll start hearing groups of characters as 'words'—just like you do during normal speech."

"That's pretty wild. Are you sure it works that way?"

"Trust me. The second thing to do is to forget about writing anything down now. And forget about how many characters you get right. Just sit back and listen to the rhythm."

"I don't know about that. You know how competitive I am..."

"Believe me, I know. But think back to what I said a few minutes ago. You've been keeping very good track of how many you get right and wrong, haven't you?" Keith nodded. "And you haven't gotten the results you wanted, have you? So, you really are too smart to continue doing something that doesn't work expecting to get different results the next time, aren't you?"

"Well, I guess it would make sense to try it your way. But isn't there something else that I should do?"

"So, why do you want to learn the code, anyway? You certainly don't need to copy the repeater ID."

"I've heard you guys talking about how the DX is back. I want to do HF."

"That's the only really good reason, as far as I am concerned, for bothering with the code. So, what kind of an HF rig do you have?"

"You know I don't have one. I'll buy one after I pass the General."

"That's my point. Do you really believe that you're going to pass the General exam?"

"Well, probably."

"Well, when?"

"I hope soon."

"If you could only hear yourself, you'd be so...embarassed."

"What are you talking about?"

"You are sounding like a wimp—a total wimp."

"Bull."

An Interview in Your Pajamas

"I'm not teasing you. Suppose you went for a job interview dressed in your pajamas. If you got past the secretary and in for the interview, the guy would ask you if you owned a suit. And you would say, 'I don't have one. I'll buy one after I get the job.' Think he'd hire you? And if he asked you if you were qualified for the job, you would say 'probably' and you 'hope to be working soon.' My guess is that very few managers would hire somebody as wishy-washy as that."

Keith sat there quietly for a long time. His face was blank, and he was staring at nothing. Finally he looked up at me, "I guess you're right. You do have to make a commitment, don't you."

"Let me read something to you, 'If one advances confidently in the direction of his dreams, and endeavors to live the life he has imagined, he will meet with a success unexpected in common hours.' "

"When did you write that? Was it in one of your columns?"

"Wish I could take credit for it, but it was a guy named Henry David Thoreau, but I doubt that you ever heard of him. I don't think he's quoted in all that many engineering books."

"Lay off. I know who Thoreau is—I mean, was."

"I think you should start seriously looking for an HF rig. How much money do you have in your toy account?"

"Well, I don't guess I specifically have an account set aside for a 'toy' as you call it. I would have to talk to Gini before I spent that much money."

"You won't get any argument from me. But I don't think she's going to give you any static on it, either. You guys seem to be making the mortgage payment every month, and between radios and computers, you spend a lot more time in your rec room than at Easy Sid's Sea Breeze Lounge."

Keith laughed at my reference to the local "pick-up" joint.

"But seriously, you should have no problem scraping together between $500 and a thousand, right? That will get you started with a good used HF rig and some wire antennas."

"Well, I think that I can handle that pretty easily. Actually, I think that I would prefer to buy a new rig. What do you think?"

"That's between you and your wallet (and Gini), but I'm inclined to agree with you if money isn't a major issue for you. The newer rigs have all the great bells and whistles, and I know how much you like to play with gadgets. You'll really get a big kick out of all the things that you can adjust on the new rigs. Seriously, though, there's always the issue of service. As smart as you are, I doubt that you'll do much servicing of your equipment, other than a routine 'oil change' or something like that. The blasted things are really complicated these days. So, if you buy a new one, you've got a year or so of automatic service through the warranty in case you need it."

"That's a major issue, for sure."

"So, when are you going to buy that new rig?" I tossed Keith a copy of CQ's *Equipment Buyer's Guide*. "This ought to get the juices flowing."

"Maybe I could find one at Dayton."

"If you can wait that long. It's still a few weeks off."

"Maybe I'll go home and practice code for an hour or two."

"No. No. No. Take it easy on the practice. You've got to be relaxed. Do it for short intervals, say, no more than 15 minutes or so at a time. You go longer than that, and fatigue sets in. Just relax and take it easy."

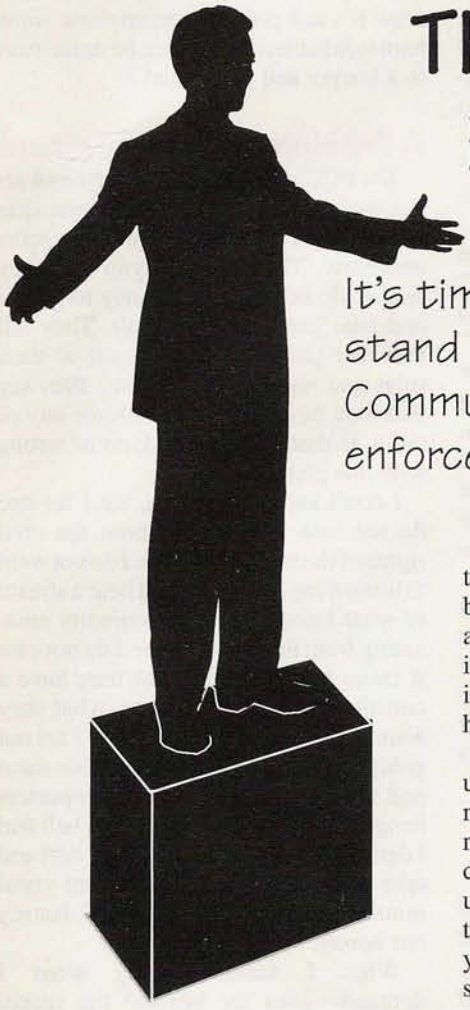
"In that case, maybe I'll stay and watch the Marlins opener with you."

"Great!"

"Guess I'll go out and smoke a cigarette before the game starts."

"Yuck." ■

The Politically Correct FCC vs. Ham Radio



It's time, says WA6ITF, for law-abiding hams to stand up and demand that the Federal Communications Commission return to its strict enforcement policies of decades past.

When I grew up, my parents taught respect for authority. I was taught to address a police officer or a fireman as "Sir." I still do so to this day. When I was first licensed in 1959, I joined a community that shared that respect, and even fear, of authority. But what happens when authority loses respect for *you*? When those you have been taught to admire simply turn their collective back on the needs of you and your peers? If you think it sounds like I'm writing about our beloved Federal Communications Commission (FCC), you're 100% correct.

**Bill Pasternak, WA6ITF, is producer of the weekly "Amateur Radio Newsline" broadcast heard on repeaters around the U.S. He lives in California.*

Back in the '50s and '60s, we hams had the utmost respect for the FCC. That is because we lived in day-to-day fear that a citation—or "pink slip"—might arrive in our mailbox for the most minor of infractions. Anyone who broke any rule had a lot of explaining to do.

One of the simplest punitive measures used by the FCC in those days was the mandatory retesting of hams who had more than one citation in a given calendar year. Nor was it uncommon to hear of unilateral license suspensions or revocations, without any hearing or appeal. If you broke the rules you were punished—severely. If you were a chronic offender, you were out—forever. Or at least for the remainder of your then five -year license term. If you were caught bootlegging after your license was suspended or revoked, the chances are that you spent a few years visiting the "gray-bar hotel." As a result, our ham bands and our hams were safe and those on the air were sane.

A Different Story Today

Today, however, the FCC's enforcement activities have all but disappeared. Law-abiding hams are frustrated and the situation on the bands gets worse and worse. I think the insanity in ham radio started in the mid-'70s. It started on the high-frequency bands with what I will call the "net haters," and on VHF/UHF with the "repeater soapboxers."

The net haters were, and remain, those hams who feel that service nets have no place in amateur radio—even during times of disaster. They transmit over the nets, often shouting insults or profanity. Prior to 1975 or thereabouts, if one of these people was located and reported to the FCC, he or she would receive a warning from the agency to cease and desist. If that person persisted in harassing a net, the next letter from the FCC would be a Notice of License Suspension. Today, the FCC simply ignores the shenanigans of the "net haters" and, in doing so, condones their activities.

The lack of caring by the FCC also creates an atmosphere in which those who are oppressed react in kind. This brings the kind of chaos and anarchy to our bands in which the "net haters" revel. They can then point their fingers and say, "...you see, we are right!"

Jammers and Soapboxers

The situation on VHF/UHF is somewhat easier to understand. Repeaters inherently are fixed-frequency devices.

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By Bill Pasternak, WA6ITF (wa6itf@juno.com)*

They cannot change frequency (QSY) when they get interference (QRM). Rather, their owners and users must find other ways of solving the problem.

Unintentional interference and QRM from another distant repeater can be attacked on a technical level. More and more systems are adopting CTCSS (Continuous Tone Coded Squelch System) and/or digital CTCSS as a method of protecting their input channels from the problems generated by a lot of RF crowded into a limited amount of bandspace.

But how do you handle interference that is best classified as "user abuse?" How do you stop given individuals, who are properly licensed, from "jamming" the signals of people they don't like? Or from using your repeater as a broadcast station for their rhetoric? How do you stop mental deviants from spewing the most foul and disgusting remarks to the world as your callsign blares out, accepting ownership of the device that is transmitting these words far and wide?

Do you shut off your repeater and thereby punish all of your users? Or do you let the verbose malcontent continue and hope that your other users will simply "talk over" him—even though you and they know that doing so is a direct violation of the FCC's rules?

The FCC and Repeaters

The FCC has never really helped to police repeater problems. By the time repeaters gained the level of popularity that brought out the dysfunctionality in some hams, the FCC was already screaming civil rights and poverty. If you went to them with a repeater-related problem, all you got was lip service. It got to a point where repeater people and their problems became *persona non-grata* at the FCC, and bringing up these issues was one way of getting a representative of the agency to clam up and walk away. All the more if there was a microphone and tape recorder nearby.

While the Commission *did* prosecute a very few high-profile cases, such as that of Richard Burton, ex-WB6JAC, they were few and far-between, and the FCC carefully avoided the repeater issue itself. For example, the three prosecutions involving Burton dealt primarily with his operating without a license. The fact that the operation was on a repeater was all but ignored.

So the problems grew worse to a point where those suffering gave up on the FCC and decided to go after the malcontents in civil court. The troublemakers responded with lawyers and lawsuits of their own, thus creating a new "cottage industry" that I call "ham radio tort law." Now it's at a point where anytime some ham is ridiculed by another, he or she runs to a lawyer and yells "sue!"

A Problem with the Picture

The FCC will tell you that it cannot act against foulmouths because Congress has never properly defined what constitutes obscenity. They will tell you that they simply do not have the money to go out and take jammers off the air. They tell you that you must observe all of their rules and regulations, but they then say that they have no way to enforce any of them. Is there something kind of wrong with this picture?

I don't know about you, but I for one do not care very much about the civil rights of the mental midgets. I do not want to turn on my ham radio and hear a stream of what I consider to be profanity emanating from the loudspeaker. I do not care if these people believe that they have a constitutional "right" to say what they want. I am tired of hearing it and I am not going to turn off my radio to make them and their politically correct supporters happy. Simply said, I am mad as hell and I demand that the FCC get off its duff and take action against that small but vocal minority of hams who are out to destroy our hobby.

What I want—actually what I demand—goes far beyond the recent offer by the ARRL to help police the bands. While I appreciate the League's position, I do not believe that it is the responsibility of a private corporation to administer federal regulation. If it were, I would be sending my income tax payments to Newington, Connecticut, instead of Washington, D.C. (*This refers to an ARRL proposal last year to privatize some interference enforcement and streamline the process of bringing chronic interference problems before the FCC.—ed.*)

Take a Step Back in Time

Rather, as a person whose yearly taxes help keep the FCC in business, I demand that the agency take a step backward in time. I demand that it stop making excuses and that it begin enforcing its Amateur Service rules with the same heavy hand that it did back in the '50s, '60s, and early

'70s. I care little about its poverty excuse, or any other excuse its bureaucrats will come up with. If the agency refuses to do the job for which it was chartered, then maybe it is time to replace the agency—and those in it—with an organization and staff that will.

My solution to the decay in ham radio is very simple: If a ham breaks a rule and the FCC is provided with proof that the offense occurred, then it must send out a "pink slip" ordering that ham off the air for 30 days, even for the most minor offense. If the problem continues, then order that ham to be retested under the VEC system on *all* elements previously passed. In the most egregious cases, I advocate license suspension for term. In other words, if you have a chronic offender who has not learned his or her lesson in getting a 30-day suspension and/or a retest, then take that person off the air so that the rest of us law-abiding citizens can enjoy ham radio.

A Legal Alternative

If the FCC continues to refuse to do the job that we the people of the United States have, through Congress, directed that it do, then we the people have an alternative. We can file a lawsuit of our own, one that seeks an injunction to force the FCC to strictly enforce all of its rules, in all services, as written, without interpretation.

If the FCC is pulled into court, it should be compelled to show cause as to:

1. Why the Commission does not enforce its regulations equally among all services;

2. Why the Commission abrogates its responsibilities as defined by Congress in the Communications Act of 1934 and subsequent amendments (this, by encouraging volunteer license examination, frequency coordination and self-policing, yet making no "official" designations of such organizations nor shielding volunteers from litigation stemming from their decisions. Could it be that the Commission does not really have the authority to do so? Yes, Congress has recently provided volunteers to federal service with some limited immunity from frivolous litigation if a volunteer is a part of a recognized public service group such as ARRL, but there is still no protection for the individual providing volunteer services on his/her own.);

3. Why, with a sudden influx of funds from amateur license fees (for vanity callsigns), there has been no increase in the budget for enforcement of amateur rules; and

4. Whether the FCC's decades-long demonstrated inability or unwillingness to provide uniform enforcement of its rules renders those rules moot.

Oppose "Political Correctness"

What I am advocating is that we in ham radio turn our backs on the "political correctness" in society and in government, that we walk away from the concept that the dysfunctional in society are to be considered the norm, and from the criticism of decency as being out of step with today's reality. It is this false judgment that has caused a great part of American society to be hooked on drugs and living on handouts. And it is the same fallacy that has led to the unchecked increase of on-air filth and acceptance of broadcast hatred in our ham radio mini society.

I am not willing to accept this continuing decay. I will no longer permit it to occur at the hands of a small but vocal number of malcontents who practice their brand of mental cruelty on the rest of us under the false guise that their activities are Constitutionally protected. If the government will not act on our behalf, then it is up to us to force it to do so. After all, it is our tax money that makes it possible for the FCC Commissioners to be chauffeured around DC! We also have the power to take those limousines away. ■

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The opinions expressed in this column are those of the author and do not necessarily reflect the views of CQ VHF *or its publisher, CQ Communications, Inc.*

If you have an opinion on this issue or another matter of importance to the VHF ham community, we'd like to hear from you. Well-reasoned, well-written commentaries will be considered for our Op-Ed page. If we publish your Op-Ed article, we'll give you a complimentary one-year subscription (or extension of your current subscription) to CQ VHF. *Submissions not accepted for the Op-Ed page may also be considered for Letters to the Editor.* CQ VHF *reserves the right to edit all submissions for length and style.*

Announcing

The ARRL VHF/UHF Spring Sprints

Lace up your running shoes...it's time once again for the ARRL Spring Sprints—brief single-band contests to get your competitive juices flowing!

Here are the rules for the 1998 ARRL VHF/UHF Spring Sprints. Under the new ARRL rules format, these rules include only what specifically applies to this event. General ARRL contest rules, and general ARRL VHF contest rules, apply as well. These general rules are available on the ARRL Web site at <http://www.arrl.org>, or in the *ARRL Contest Yearbook*.

1. Object: To work as many amateur stations in as many 2 degrees by 1 degree grid squares as possible, using authorized amateur frequencies on the 50, 144, 222, 432, 902, 1296 and 2304 MHz bands.

2. Contest Period:

2.1. The 144 MHz Sprint will be from 7 PM until 11 PM local time on the Monday that falls on April 10 through 16 (April 13, 1998).

2.2. The 222 MHz Sprint will be from 7 PM until 11 PM local time on Tuesday of the following week (April 21, 1998).

2.3. The 432 MHz Sprint will be from 7 PM until 11 PM local time on Wednesday of the following week (April 29, 1998).

2.4. The 902 MHz, 1296, and 2304 MHz Sprints will each be on Saturday of the following week (May 9, 1998).

2.4.1. The 902 MHz, 1296 MHz Sprint, and 2304 MHz Sprint run from 6 AM until 1 PM local time:

2.4.2. You may operate any five consecutive hours during this time period.

2.4.3. These Sprints are separate, but run concurrently.

2.5. The 50 MHz Sprint will be from 2300Z Saturday of the following week until 0300Z Sunday (May 16-17, 1998).

3. Exchange: Grid-square locator (see April, 1994 *QST*, page 86).

3.1. Exchange of signal report is optional.

4. Scoring:

4.1. QSO Points: Count one point for each complete QSO.

4.2. Multiplier: The total number of different grid squares worked. Each 2 degrees by 1 degree grid square counts as one multiplier.

4.3. Final score: Multiply QSO points by multipliers. Each Sprint is scored separately.

5. Reporting: Entries must be postmarked before 30 days after the contests. No late entries can be accepted. Official entry forms, available from ARRL HQ in the *ARRL Contest Yearbook*, are recommended. The results will be listed in *NCJ* (the *National Contest Journal*.).

6. Other: See rules for All ARRL Contests and for VHF Contests.

(*Courtesy ARRL Contest Branch*)

Hamfest Calendar *(from page 35)*

April 25, Annual Hamfest, Sonoma Valley Veterans' Memorial Building, **Sonoma, CA**. Talk-in: 145.35, -600, PL 88.5. For information, contact Darrel, WD6BOR, at (707) 996-4494. (exams)

April 25, 21st Hamfest, Graham Arena East Olmsted County Fairgrounds, **Rochester, MN**. For information, contact NØHZN, 4552 5th Street NW, Rochester, MN 55901; (507) 285-6522; e-mail: <nøhzn@aol.com>; WWW: <http://members.aol.com/ rarchams>.

April 25, 2nd Annual Hamfest, next to West Greenwich Fire Station, **West Greenwich, RI**. Talk-in: 147.165, 145.130, simplex 146.580. For information, contact Bill May (104) 822-0520 or Everet Lovenbury, N1VEZ, (401) 539-1107. (exams)

April 26, 14th Annual Hamfest/ Computer/Electronics Fleamarket, Canfield Fairgrounds, **Canfield, OH**. Talk-in: 147.315(+) or 443.225(+) Alt. 145.275(-). For information, contact Sect. Sharon Spencer, 424 Peffer Street, Niles, OH 44446, (330) 544-3666.

April 26, 36th Annual Hamfest, Moultrie/Douglas County Fairgrounds, **Lovington, IL**. Talk-in: 146.055/146.655 and 449.275/444.275. For information, contact MARK, P.O. Box 91, Lovington, IL 61973, or call (217) 543-2178 (daytime) or (217) 873-5287 (evenings).

April 26, Annual Hamfest & State Convention, Nur Temple, **New Castle, DE**. Talk-in: 147.225+ or 224.220/R. for information, contact Hal Frantz, KA3TWG, (302) 793-1080; e-mail: <hfrantz@magpage.com>.

Packet Radio

Basics

Putting your computer on the air with "packet radio" is easy and fun. Here are the basics of what you'll need and how to make contacts. Watch for other articles in *CQ VHF* with more detailed information.

Equipment Needs

• A personal computer or data terminal (sometimes called a "dumb" terminal).

• A ham transceiver, generally a 2-meter (144 MHz) or 70-centimeter (440 MHz) FM rig, mobile or handheld, and an antenna.

• A Terminal Node Controller (TNC). This is the translation and housekeeping device that wraps up your information "packets" to be sent on the radio and unwraps the packets your radio receives. The TNC is connected to your computer's RS-232 (serial) port and to your radio's mic and speaker jacks.

• Cables to connect the equipment together. A standard serial cable will usually work for the computer-to-TNC connection (make sure the cable matches the connectors on both units). But you may have to make your own TNC-to-radio cable, since mic connectors vary greatly from rig to rig. Check the manuals for both the radio and the TNC, then match up the following:

TNC		RIG
Data Out	<==>	Audio In
Data In	<==>	Audio Out or Speaker Jack
Switching	<==>	Push-to-Talk (PTT)
Ground	<==>	Ground or shield **

*(** You may need to wire together the ground or shield terminals for the PTT line and the Audio In line on the mic connector.)*

Getting Ready

Once everything is wired up, you're ready to get started. Your TNC will turn on in the "command" mode. This means that anything you type in will be read as an instruction to the TNC and won't be sent out on the air. The first command you should type in is **MY (space) <your callsign>**, then press **<ENTER>**. This assures that your callsign is attached to every packet you send out. Next, type **MRPT ON** and press **<ENTER>**. This command means "monitor repeater" and will allow you to see (on your screen) the callsigns of not only the sending and receiving stations, but also of any relaying stations.

Now, begin by listening. Tune around for the distinctive "BRAAAP" sound of packet signals. You're most likely to find some on 145.01, 145.03, 145.05, 145.07, and 145.09 MHz. Adjust your receive volume until you begin to see packets (bits of messages) appear on your screen.

Each packet starts with a string of callsigns. The call of the sending station is first, then any relay stations, and, finally, the destination station. The callsign with a star (*) next to it is the one you're actually hearing and is probably close enough for a direct contact. If it's a callsign with a dash and a number after it, or if it's an ID that doesn't look like a callsign, then it's probably a network relay station (also called a "node") and not a real person at a keyboard.

On the Air

Contacting someone on packet is called "connecting." You can connect with people either directly or through a network of relay stations. To make a direct connection, just type **C**, a space, the call of the person you want to contact, and then press **<ENTER>**. If the link is made, your TNC will print **"*** CONNECTED TO <CALLSIGN>"** on your screen. At that point, your TNC automatically switches from the "command" mode to the "converse" mode, and everything you type will be sent directly to that person until you disconnect. To disconnect when you're done, return to the Command mode (see your TNC manual for details) and type **D <ENTER>**. You will soon get a **"***DISCONNECTED"** message.

Connecting through a network requires extra steps, but this is where the real fun of packet begins. The most popular type of packet network is called "TheNet." You enter by connecting to a local "node." Sometimes, nodes have "aliases" in addition to callsigns. For example, the WA2JVM-2 node in West Orange, New Jersey, is also known as "WORANG." You'd connect by typing **C WORANG <ENTER>** and waiting for a connected message. You can then connect to anyone else logged onto the node (by repeating the connect sequence) or you can connect to another node (if you type **NODES <ENTER>**, the node will send you a list of places it can connect you to), or to several nodes, and so on from there.

Once you're connected to WORANG, you can connect to a New York City node with direct satellite links to London and Los Angeles! (Who says you can't talk far on packet?) When you get to the node you want, you can connect to another station or tell the node to call CQ for you. When you're done, type **B** (for "bye") alone on a line and press **<ENTER>**. You may have to repeat that for each node in the chain you've built, until you get a ***DISCONNECTED** message from your starting node.

There's a whole different set of commands once you log into a packet bulletin board (PBBS) or a DX "Cluster." If you get confused, you can often get help by typing **/h <ENTER>** or **/? <ENTER>** Once you get the basics down, you'll be able to discover all of the fun that packet offers. ■

Advertisers' Index

It's easy to advertise in CQ VHF. Let me know what I can do to help. Arnie Sposato, N2IQO. Tel: 516-681-2922, Fax: 516-681-2926,e-mail:arnie cq@aol.com.

HAM SHOP

VHF GE RADIOS: Used GE MastrII Comb. EX76KKP66C. Thses are 8 channel 100 watt units in double cases with the PLL exciters. Units are good conditions but as is, radio w/o acc. $80, with acc. $150 plus s/h. Call DAVID (205) 553-3059.

Join the **LAMBDA AMATEUR RADIO CLUB** (Larc) since 1975, the only open and visible public service-oriented ham club for gay and lesbian hams. Monthly newsletter, HF skeds, internet listserv and IRC, hamfest meetings, chapters, DXpeditions. Write LARC, PO Box 56069, Phila., PA 19130-6069 or e-mail: <LARC@net-quest.com>.

ALUMINUM chassis–cabinet kits, UHF and VHF antenna parts. K3IWK, 5120 HARMONY GROVE RD., DOVER, PA 17315-3016.

WANTED: Older model bugs, unusual bugs, and miniature hand keys. State price, condition. Dave Ingram, K4TWJ, 4941 Scenic View Drive, Birmingham, AL 35210

Learn Code by Hypnosis—http://www.qth.com/cweasy/ or 1-800-425-2552.

Looking for "Looking Ahead?" Look back—it's on page 55.

Something New...

Advertise Your Club or Class Here FOR FREE!...
...or Your Personal or Commercial Web Site for PRACTICALLY FREE!

Well, you've probably noticed that we haven't had too many classified ads here lately...frankly, we've never had too many classifieds (that no-good Internet!). So, starting with our **May** issue—next month—we're going to be trying something new: *free listings* of clubs, licensing classes, and exam sessions! *Plus,* for the staggering sum of $1/month or $10 for a full year, we'll also offer listings of **ham-related** *personal* Web sites (*commercial* **ham-related** Web listings will be $5/month or $50 for a full year).

Here are some guidelines to follow:

• **Club listings**—First of all, be sure that your club has some VHF interest. Then, send us your club name, meeting date/time/location, mailing address, and other contact information (e.g., phone, fax, e-mail, Web site, repeater frequency). If your club has a specialty, include it so we know which category to put it in.

• **Class listings**—If you'll be running a licensing or upgrading class, let us help you spread the word. Give us at least three months' notice (no later than March 1 for the May issue; April 1 for the June issue, etc.), and send us the class location, starting date/time, duration (# of sessions), any costs for students, and contact information (name, address, phone, fax, e-mail, Web site, etc.). Also include the name of the sponsoring group (if any) and the license class(es) for which the course will prepare students.

• **Exam sessions**—Same basic drill as for classes: date, time, location, sponsoring group, and contact information (same as above); plus fees, which VEC your group is affiliated with, and whether pre-registration is required/recommended. If your sessions recur on a set schedule (e.g., 2nd Saturday of every month), put that in and we'll keep repeating the listing.

• **Personal Web site listings**—Send us your name, callsign, mailing address (for our files), URL (Web address), and any ham radio specialties to which your site caters (e.g., weak-signal, microwaves, etc.). Plus, of course, a check or money order for $1 U.S. for each month in which you'd like it to appear ($10 for a full year, if you buy the whole year at one time).

• **Commercial Web site listings**—If your company makes, sells, or fixes anything related to VHF/UHF ham radio, list your Web site with us. Our surveys show that the majority of our readers use manufacturer/dealer Web sites to learn more about your products and communicate with customer service. Send us your company name, mailing address (for our files), URL (Web address), and a very brief description of your products or services. Cost is $5/month or $50 for a full year (if you buy the whole year at one time).

All Web site listings must be accompanied by payment in full in check or money order in U.S. dollars and mailed to *CQ VHF Weblink,* Attn: Bernadette Schimmel, 76 N. Broadway, Hicksville, NY 11801. Credit card orders also accepted by mail, phone (516) 681-2922, or fax (516) 681-2926. Club, class, and exam listings may be submitted as above, to *CQ VHF Clublink,* or by e-mail to CQVHF@aol.com. Be sure to say what it is in the subject line (e.g., club listing).

Ultra Compact Dual Band Handheld **FT-50RD**

One tough little dual bander!

Features

- Frequency Coverage
  Wide Band Receive
  RX: 76-200 MHz, 300-540 MHz, 590-999 MHz*
  TX: 144-148 MHz, 430-450 MHz
- AM Aircraft Receive
- MIL-STD 810 Rating
- Digital Coded Squelch (DCS)
- 112 Memory Channels
- 12V DC Direct Input
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- Alphanumeric Display
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- Direct FM
- High Audio Output
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"You notice how loud this HT's audio is?"

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"Easy to operate, small, great price!"

"Yaesu did it again!"

US MILITARY APPROVED MIL-SPEC 810

The foremost in top-performing, durable, dual band handhelds now includes the FTT-12 DTMF keypad with CTCSS enc/dec, DCS enc/dec, DVRS and paging/coded squelch. Manufactured to rigid commercial grade standards, the FT-50RD is the only amateur dual band HT to achieve a MIL-STD 810 rating. Already a winner; the deluxe keypad makes this stand-out HT even better! Water-resistant construction uses weather-proof gaskets to seal major internal components against the corrosive action of dust and moisture. And, the rugged FT-50RD withstands shock and vibration, so throw it in with your gear!

Exclusive features set the FT-50RD apart, too. Wide Band Receive includes 76-200 MHz (VHF), 300-540 (UHF), and 590-999 MHz*. Dual Watch checks sub-band activity while receiving on another frequency, then when a signal is detected, shifts operation to that frequency. Digital Battery Voltage displays current operating battery voltage. Digital Coded Squelch (DCS) silently monitors busy channels. Auto Range Transpond System™ (ARTS™) uses DCS to allow two radios to track one another. And, the FT-50RD is ADMS-1C Windows™ PC programming compatible, too. To round out the FT-50RD, it has four battery savers, and super loud audio—remarkable in an HT this size.

A reliable companion where ever you go, the FT-50RD is one tough little dual bander with all the features you want!

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FT-10/40R
Ultra Compact Handhelds
VHF or UHF. Similar to FT-50RD including MIL-STD 810, and other exclusive features.

Seeing is Transceiving

Portable SSTV is here! Kenwood's new VC-H1 Visual Communicator combines an image-scan converter, CCD camera and LCD monitor in a compact battery-operated unit. Simply hook it up to your Kenwood transceiver to start sending and receiving color images over the air.

VC-H1 Visual Communicator

◗ Ideal for outdoor SSTV

Until now, for anyone interested in SSTV (slow-scan television), portability has not been an option. But thanks to component miniaturization the VC-H1 is not only small enough for handheld use but it runs off 4 AA batteries so you can take it anywhere. This makes it ideal for field days, special events, disaster communications and even fishing trips.

◗ Full compatibility

The VC-H1 can be connected to any transceiver with just a cable, and it offers full compatibility with all of the standard SSTV formats. Uploads/downloads are quick and easy; the images are also sharp and clear.

◗ All-in-one design

In addition to the detachable 1/4-inch CCD camera, the VC-H1 features a 1.8-inch color TFT (thin film transistor)-type display. As well as viewing incoming pictures, you can review your own prior to transmission. The built-in microphone & speaker can be used in place of a separate speaker-microphone for your transceiver.

◗ Image memory

Up to 10 pictures can be stored in memory. This allows you to compare and pick the best shot to send. You can also store incoming pictures and protect them from unintentional deletion.

◗ Computer connectivity

One of the great features of the VC-H1 is the ability to work with a personal computer. Hook it up to the RS-232C port on your laptop using the optional connection kit (includes Microsoft® Windows® 95 software) and you can save pictures (in JPEG format) that you send and receive. You can then cut and paste using standard graphics software, or even superimpose your own text. What's more, you can actually control the VC-H1 from your computer.

◗ Call sign superimpose
◗ AF mute
◗ Auto power-off

SPECIFICATIONS

• Terminals : Data I/O (for transceiver), Video in, Video out, COM (for computer),DC IN (4.8 ~ 7.0V) • Dimensions, projections not included (WxHxD): 2-5/8 x 1-3/8 x 6-3/4 in (62 x 30 x 160 mm)

Specifications are subject to change without notice.
Screen-shot photographs are simulated.
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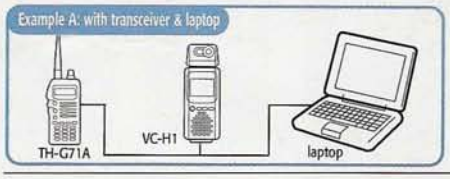

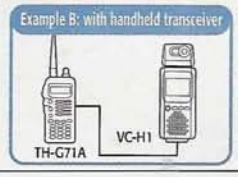

TH-G71A
144/440MHz
FM Dual Bander

- 6W (VHF), 5.5W (UHF)
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- 200 memory ch. with alphanumeric display
- MIL-STD 810E (rain & shock)
- CTCSS tone scan
- DTMF memory (10 ch. up to 16 digits)
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